

BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

DECEMBER, 1898.

W. L. ASHE, MARSDEN MANSON, J. R. PRICE
Commissioners.



SACRAMENTO:

A. J. JOHNSTON, : : : : : SUPERINTENDENT STATE PRINTING.

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STATE CAPITOL, SACRAMENTO, CALIFORNIA, }
DEPARTMENT OF HIGHWAYS, }
December 17, 1898.

To HON. JAMES H. BUDD, *Governor*:

SIR: We herewith submit, for your consideration, the report of this Department, from May, 1897, to date, as provided for in Chapter CCLXII, of Statutes and Amendments of 1897.

We take this occasion to express our obligation to the Honorable Attorney-General of the State, for services and advice, and to county officials for coöperation in the work of collecting statistics regarding highway expenditures and structures; also, to the officers and members of the Good Roads League, who have taken up the work of road reform.

Very respectfully,

W. L. ASHE,
MARSDEN MANSON,
J. R. PRICE,
Commissioners.

Attest: A. L. HENRY, Secretary.

REPORT OF THE DEPARTMENT OF HIGHWAYS.

LAWS AND AMENDMENTS RECOMMENDED.

In order to introduce system and economy into the expenditure of road funds, this Department recommends the subjoined laws and amendments. They are the result of the earnest studies of the members, and are based on examinations extending throughout every county in this State, and of special studies of the road system of England, France, Germany, Russia, Switzerland, and Italy. If the expenditures which this State has made for this work are to result in anything, it must be in a fair and thorough trial of these measures, and without the crude modifications which may be suggested by those whose duties do not permit them to make a thorough study of the entire subject. The measures are not radical, they do not subvert the method of road administration in the State, but they do present practical lines along which the evils of the present system may be corrected. Minor defects may be adjusted at future sessions of the Legislature, and improvements may be grafted upon the system herein proposed, as knowledge of road-building extends. The laws and amendments are as follows:

(1) An Act to classify the roads of the State of California, and to define each class.

(2) To amend Article III, Section 2643, par. 7, P. C., so as to set apart fifty (50) per cent of the levy therein made for permanent road work on such highways, as the county authorities may deem best.

(3) An Act to provide for the acceptance of highways of the first class by the State, and for the maintenance of the same, and to make an appropriation therefor.

(4) To amend Section 2651, to correspond with Section 2643 as amended.

(5) An Act to provide for the location, construction, and maintenance of highways, owned and controlled by the State, by the levy of a tax, and the creation of a fund therefor.

(6) An amendment to Chapter CXVII, Statutes and Amendments of 1897—the wide-tire law.

(7) An amendment to Chapter CCLXXII, creating the Department of Highways.

These acts and amendments are appended in full:

AN ACT

TO CLASSIFY THE ROADS IN THE STATE OF CALIFORNIA, AND TO DEFINE EACH CLASS.

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. The roads within the limits of the State of California shall hereafter be classified as follows:

The first class to include all highways designated as State Highways; the second class to include all highways designated as County Thoroughfares; and the third class to include all highways designated as District Roads.

SEC. 2. The following roads, when definitely located by the Department of Highways, are hereby declared to belong to the first class:

1. A highway commencing on the State line between the State of California and the State of Oregon, at or near the point where the said State line is intersected by the road from Yreka, California, to Ashland, Oregon, and extending thence southerly, along the best grades and alignments, through the counties of Siskiyou, Shasta, Tehama, Butte, Yuba, Sutter, Sacramento, San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare, Kern, Los Angeles, Orange and San Diego, to Tia Juana, in the last-named county.

2. A highway commencing at Crescent City, in Del Norte County, and extending south and southeasterly, on the best grades and alignments, through the counties of Del Norte, Humboldt, Mendocino, Sonoma, and Marin, to the City of Sausalito.

3. A highway commencing in the City and County of San Francisco, and extending thence southeasterly, on the best grades and alignments, through the counties of San Mateo, Santa Clara, San Benito, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles, to the City of Los Angeles.

4. A highway commencing at a point upon the State Highway through Tehama County, at or near the station of Tehama, and extending thence southerly, on the best grades and alignments, through the counties of Tehama, Glenn, Colusa, Yolo, and Solano, to the City of Vallejo.

5. A highway commencing at the City of Martinez, and extending thence southerly, on the best grades and alignments, through the counties of Contra Costa, Alameda, San Joaquin, Stanislaus, Merced, Fresno, Kings, and Kern, to a point on the State Highway through Kern County, at or near the City of Bakersfield.

6. A highway commencing at a point upon the State Highway through Siskiyou County, near the westerly base of Mount Shasta, and extending thence southerly, on the best grades and alignments, through the counties of Siskiyou, Shasta, Lassen, Plumas, Sierra, Nevada, Placer, El Dorado, Alpine, Mono, Inyo, and Kern, to Indian Wells, in the last-named county.

7. A highway commencing at the City of Arcata, in Humboldt County, and extending thence southeasterly, on the best grades and alignments, through the counties of Humboldt, Trinity, and Tehama, to a point on the State Highway through Tehama County, at or near the City of Red Bluff.

8. A highway commencing at a point on the State Highway through Shasta County, north of the City of Redding, and extending thence northeasterly, on the best grades and alignments, through the counties of Shasta, Lassen, and Modoc, to Fort Bidwell, in the last-named county.

9. A highway commencing at the City of Marysville, and extending thence northerly and northeasterly, on the best grades and alignments, through the counties of Yuba, Butte, Plumas, and Lassen, to Susanville, in the last-mentioned county.

10. A highway commencing at the City of Ukiah, and extending thence southerly, on the best grades and alignments, through the counties of Mendocino, Lake, and Yolo, to the City of Sacramento, thence easterly, through the counties of Sacramento and El Dorado, to a point on the State line between the State of California and the State of Nevada, at or near its intersection by the Lake Tahoe Wagon Road.

11. A highway commencing at or near the City of Santa Rosa, and extending thence southeasterly, on the best grades and alignments, through the counties of Sonoma, Napa, and Solano, to Suisun, in the last-named county.

12. A highway commencing at a point on the State Highway running north from Sacramento, and extending thence northeasterly, on the best grades and alignments, through the counties of Sacramento, Placer, Nevada, and Sierra, to a point on the State Highway through Sierra County, near Sierraville, in the last-mentioned county.

13. A highway commencing at the City of Oakland, and extending thence easterly, on the best grades and alignments, through the counties of Alameda and San Joaquin, to a point on the State Highway through San Joaquin County, south of the City of Stockton.

14. A highway commencing at the City of Oakland, and running thence northerly and easterly, on the best grades and alignments, through the counties of Alameda and Contra Costa, to the City of Martinez.

15. A highway commencing at Ione, Amador County, and extending thence easterly, on the best grades and alignments, through Amador, Calaveras, Tuolumne, and Mariposa counties, to the county seat of the last-named county.

16. A highway commencing at a point on the State Highway through Santa Clara County, at or near the City of Gilroy, and extending thence northeasterly, on the best grades and alignments, through the counties of Santa Clara, San Benito, Merced, Mariposa, Tuolumne, and Mono, to a point on the State Highway through the last-named county, near Mono Lake.

17. A highway commencing at a point on the State Highway through Santa Clara County, at or near the City of Gilroy, and extending thence southeasterly and easterly, on the best grades and alignments, through the counties of Santa Clara, San Benito, and Fresno, to the City of Fresno.

18. A highway commencing at the City of Modesto and extending thence northeasterly, on the best grades and alignments, through the counties of Stanislaus and Tuolumne, to the City of Sonora.

19. A highway commencing at or near the City of Hollister, and extending thence southeasterly, on the best grades and alignments, through the counties of San Benito and Fresno, to a point on the westerly State Highway through the last-named county, near Huron.

20. A highway commencing at a point on the State Highway through San Luis Obispo County, at or near San Miguel, and extending thence easterly, on the best grades and alignments, through the counties of San Luis Obispo and Kern, to a point on the westerly State Highway in the last-mentioned county.

21. A highway commencing at Port Harford, in San Luis Obispo County, and extending thence southeasterly and northeasterly, on the best grades and alignments, through the counties of San Luis Obispo, Santa Barbara, and Kern, to Indian Wells, in the last-named county.

22. A highway commencing at the City of Los Angeles and extending thence easterly on the best grades and alignments, through the counties of Los Angeles and San Bernardino, to the City of San Bernardino; thence southwesterly, on the best grades and alignments, through the counties of San Bernardino, Riverside, and Orange, to the City of Santa Ana, in Orange County.

23. A highway commencing at a point on the State Highway through Shasta County, north of the City of Redding, and extending thence northwesterly, on the best grades and alignments, through the counties of Shasta and Trinity, to Weaverville, in the last-named county.

24. A highway commencing at Colusa, and extending thence westerly, on the best grades and alignments, through the county of Colusa, to a point on the State Highway through said county.

25. A highway commencing at Markleeville, and extending thence easterly, on the best grades and alignments, to a point on the State Highway through Alpine County.

26. A highway commencing at Mariposa, and extending thence northwesterly, on the best grades and alignments, to a point on the State Highway through Mariposa County.

27. A highway commencing at the City of Visalia and extending thence westerly, on the best grades and alignments, through the counties of Tulare and Kings, to the City of Hanford, in Kings County.

28. A highway commencing at a point on the State Highway through Alameda County, at or near Niles, and extending thence southerly, on the best grades and align-

ments, through Alameda and Santa Clara counties, to the City of San José; thence southwesterly, on the best grades and alignments, through the counties of Santa Clara and Santa Cruz, to a point on the State Highway through Santa Cruz County, near Watsonville.

29. A highway commencing at the City of Sonora, and extending thence easterly, on the best grades and alignments, through the counties of Tuolumne and Mono, to a point on the State Highway in the last-named county.

SEC. 3. The roads of the second class, or County Thoroughfares, shall be the most important roads in each county, as set apart and so declared by the Boards of Supervisors of the several counties, in discharging which duty they may call upon the Department of Highways, in writing, for such advice and counsel as said Boards of Supervisors may desire.

SEC. 4. The roads of the third class, or District Roads, shall embrace all existing county roads now recognized and set apart by law, and not enumerated in sections two and three of this Act as State Highways or County Thoroughfares, together with such additional roads as may be laid out, in accordance with the laws of the State of California, by the Boards of Supervisors of the several counties.

SEC. 5. All Acts or parts of Acts in conflict with the provisions of this Act are hereby repealed.

SEC. 6. This Act shall take effect from and after its passage.

Article III, Section 2643, par. 7, Political Code, to be amended as follows:

Cause the road tax collected each year to be apportioned and kept in separate funds by the County Treasurer, as follows:

Fifty per cent of all moneys so collected shall be apportioned as now provided by law. The remaining fifty per cent of taxes so collected shall be apportioned to a fund to be known and designated as the "Good Roads Fund." All moneys so apportioned to the "Good Roads Fund" must be expended by the Boards of Supervisors of the various counties in the following manner, and for the purposes hereinafter named, and in no other way, and for no other purposes, to wit:

For laying out, grading, draining, sprinkling, graveling, or macadamizing the principal highways of the county, and the purchase of all road machinery necessary for the construction of said highways and maintenance of same, and the purchase of water rights, and all necessary property to insure a perfect sprinkling system; for the construction of all substructures necessary to the perfect drainage of a highway or road, all of which substructures shall consist of masonry, concrete, salt-glazed sewer pipe, iron or steel; no lumber nor perishable material shall be used, except for bridge flooring, when deemed absolutely necessary.

For the better guidance of road construction and the expenditure of moneys in the "Good Roads Fund," the following shall be the order of constructing said highways, and the Boards of Supervisors shall observe this order, so far as possible so to do:

First—The laying out of a highway on the best grades and alignments possible.

Second—The grading and draining of said highways.

Third—The construction of permanent substructures.

Fourth—The establishment of a sprinkling plant for said highways.

Fifth—The graveling or macadamizing of all such highways.

To perform any work or construct any substructures under this section, the Board of Supervisors must, by proper order, direct the County Surveyor to make definite surveys of the proposed work and to prepare plans, profiles, and cross-sections thereof, and to submit the same, with estimate of the amount, or amounts, of work to be done, and the probable cost thereof, and with specifications therefor, duly approved by the Department of Highways of the State of California. The said report shall be prepared in triplicate, one copy to be filed in the Surveyor's office, one with the Department of Highways of said State, and the other to be filed with the clerk of the Board of Supervisors. The board, upon receipt of such report, must advertise for bids for the performance of the work specified, as provided in this section. All bidders must be afforded opportunity to examine such plans and specifications, and said board shall award the

contract to the lowest responsible bidder, and a copy of the plans and specifications so adopted shall be attached to and become a part of the contract; and the person, or corporation, to whom the contract is awarded shall be required to execute a bond, to be approved by said board, for the faithful performance of such contract; *provided*, that after the submission of the bids as herein provided, the Board of Supervisors being advised by the County Surveyor that the work can be done for a sum less than the lowest responsible bid, it shall then be their privilege to reject all bids, and to order the work done or structure built, by day's work, under the supervision and control of said Surveyor; *provided further*, that the Surveyor in each case shall be held personally responsible, under his official bond, to construct the work and furnish material, at cost not to exceed the amount of the lowest responsible bid received.

The furnishing of all material or machinery for the purposes of this Act shall be done by contract and advertisement for bids in the same manner as far as possible as designated herein for road work.

The Board of Supervisors shall decide all questions pertaining to this Act by a majority vote of all members of the board.

The County Surveyor and Department of Highways of the State shall have power to inspect any work or advise as to the efficiency or quality of all materials so purchased by the Board of Supervisors for the purposes of this Act, and upon the written request of the Surveyor and Department of Highways, any failures to comply with the contract or contracts, or any defects in the character of material furnished, shall be remedied by the contractor, and in default thereof, the board shall have power to deduct the value of such failure or defect from the contract price agreed to be paid the contractor.

The Board of Supervisors must employ the County Surveyor to superintend the work contemplated by this Act, and, provided said Surveyor is not a salaried officer, must allow him fair compensation for such service.

The Board of Supervisors shall have the power to make partial payments upon all contracts let by virtue of this Act, not to exceed seventy-five per cent of the work done when the same shall be certified by the County Surveyor as properly performed.

No contract shall be let in conformity to this Act exceeding the amount of money in the "Good Roads Fund" of any county, or the estimated amount to be paid into said fund during the fiscal year in which said contract is entered into.

Section 2651, Political Code, amended to read as follows:

The Board of Supervisors must annually set apart from the property road tax collected from all sources, fifty (50) per cent, to be set aside as provided in Article III, Section 2643, par. 7, Political Code; thirty-five (35) per cent of the remainder of said road tax may be set aside for general county road purposes; from which sum so set apart they may direct such amounts to be paid as may be found necessary for such general county road purposes in which the inhabitants of all the districts within the county are more or less interested, or to assist weak or impoverished districts in keeping their roads in repair, to be applied as the said board may order or direct; *provided*, that the Boards of Supervisors in the several counties shall have no power to create a debt on any road district in excess of the estimated amount of receipts from said district for the current fiscal year.

AN ACT

TO PROVIDE FOR THE ACCEPTANCE OF HIGHWAYS OF THE FIRST CLASS BY THE STATE' AND THE MAINTENANCE OF THE SAME, AND TO MAKE AN APPROPRIATION THEREFOR.

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. Whenever five (5) or more consecutive miles of a highway of the first class, as defined in an Act entitled "An Act to classify the roads in the State of California, and to define each class," shall have been located and constructed within the limits of any county, in conformity with plans and specifications approved by the Department of Highways, the Board of Supervisors of such county may petition the Department of Highways to accept said portion of road and to maintain the same.

SEC. 2. Said Department shall thereupon examine said road and certify to the Gov-

error of the State whether or no such location and construction have been in conformity with the plans and specifications therefor, and if in its opinion said road should be accepted. Should such opinion be favorable and meet the approval of the Governor, such road must then be accepted by the Department in the name of the State, and shall thereafter be maintained by the Department of Highways, as provided by law.

SEC. 3. An appropriation of one hundred thousand dollars, or so much thereof as may be necessary, is hereby made for the purposes of carrying out the provisions of this Act during the fiscal years of 1899-1900 and 1900-1901; said fund to be designated as the "State Highway Maintenance Fund."

SEC. 4. On or before September 1, 1900, and biennially thereafter, the Department of Highways must certify to the State Controller the amount necessary to maintain said highways of the first class for the following two fiscal years. The Controller shall include this amount in his estimate of expenditures, and which, when paid into the State Treasury, must be credited to said fund.

SEC. 5. The Department of Highways is hereby authorized to advertise for bids in two newspapers in the county in which the road is situated, for contracts to sprinkle roll, and maintain such State Highways as may be accepted under the provisions of this Act, and for the necessary appliances and machinery for said work. Said Department shall have the power to reject any and all bids and order the work done by day's labor for an amount less than the lowest responsible bidder, and the commissioner is responsible on his bond that the work shall be done according to the plans and specifications. Said bids to be filed with the County Clerk of the county in which said highway is situated, and to be opened by the Commissioner of the Department of Highways at the office of said clerk on a day specified in said advertisement for bids.

SEC. 6. The money paid into the State Highway Maintenance Fund is hereby appropriated, without reference to fiscal years, for the exclusive purpose of maintaining State Highways. All claims against the State Highway Maintenance Fund must be made by warrants drawn against said fund by the State Controller in the name of the person or persons rendering the services or furnishing material provided for in this Act, and must be audited and approved by the Commissioner of the Department of Highways and by the State Board of Examiners. The State Controller is hereby directed and authorized to draw said warrants, when so audited and approved, and the State Treasurer is authorized to pay said warrants to the extent of moneys available therefor.

SEC. 7. This Act shall take effect upon and after its passage.

AN ACT

TO PROVIDE FOR THE LOCATION, CONSTRUCTION, AND MAINTENANCE OF HIGHWAYS, OWNED OR TO BE ACQUIRED BY THE STATE OF CALIFORNIA, BY THE LEVY OF A TAX, AND THE CREATION OF A FUND THEREFOR.

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. There is hereby levied annually, for each fiscal year, an "ad valorem" tax of two and one-half cents upon each one hundred dollars (\$100) of value of the taxable property of the State, which tax shall be collected by the several officers charged with the collection of State taxes, in the same manner and at the same time as other State taxes are collected, upon all classes or any class of property, which tax is for the location, construction, and maintenance of highways owned or to be acquired by the State of California.

SEC. 2. The State Board of Equalization, at the time when it annually determines the rate of State taxes to be collected, must, at the same time, declare the levy of said rate of two and one half cents upon each one hundred dollars (\$100) of value of taxable property, and notify the Auditor and Board of Supervisors of each county thereof.

SEC. 3. The money collected from said rate, after deducting the proportionate share of expenses of collecting from the same, to which other State taxes are subject, must be paid into the State Treasury, and be by the Treasurer converted into a separate fund, hereby created, to be called "The State Highway Fund."

SEC. 4. The money paid into said "State Highway Fund" is hereby appropriated, without reference to fiscal years, for the exclusive purposes of locating, constructing,

and maintaining State Highways, and in no case shall any portion thereof be used for the acquisition of title to nor rights of way over land or lands through or upon which said State Highways may be located. All claims against said "State Highway Fund" must be audited by the Department of Highways, and approved by the State Board of Examiners, and payments shall be made out of said fund only upon warrants drawn against the said "State Highway Fund" by the State Controller, in the name of the person or persons rendering the services or furnishing material provided for in this Act; and the State Treasurer is hereby directed and authorized to pay said warrants.

SEC. 5. Not more than eight per cent of the money derived from said "State Highway Fund" shall be expended in any one county of the State in any one fiscal year.

SEC. 6. All Acts or parts of Acts in conflict with the provisions of this Act are hereby repealed.

SEC. 7. This Act shall take effect and be in force from and after its passage.

Chapter CXVII, Statutes and Amendments, 1897, to be amended as follows:

SECTION 1. The width of tires for wheels upon wagons or other vehicles to be used upon highways in the State of California shall be, for the following styles of wagons, as follows:

One and one half and one and five eighths inch steel or iron axle;	} Not less than two
two and three fourths and three inch steel or iron thimble skein axle;	
two and one eighth and two and three quarters tubular axle.	} and one half
	} inch tires.

One and three quarters and one and seven eighths inch steel and	} Not less than
iron axle; three and one fourth steel or iron or thimble skein; two	
and five eighths inch tubular axle.	} three inch tires.

All other vehicles with an axle greater in size or capacity than those above enumerated shall have tires of not less than four (4) inches in width.

Section 3 to be repealed.

Section 4 to be numbered 3.

Section 5 to be numbered 4.

Sections 8 and 9 of Chapter CCLXXII to be amended to read as follows:

SEC. 8. The Department of Highways shall take possession, in the name of the State, and as rapidly as the funds provided therefor will permit, of all roads which have been or may be declared State Highways, and in cases where the Legislature may define the general direction and route of a State Highway, the Department shall definitely locate the same upon the best grades and alignments, and as closely following the general lines defined by the Legislature as the topography of the country will permit, and in consonance with the best interests of the State; and wherever the location of an existing county road, or any portion thereof, is such that it may be properly defined as a State Highway, or a portion thereof, then the location of such county road shall be utilized for said State Highway; *provided*, that all highways included within the boundaries of the lands of State institutions, parks, or reservations, now governed by bodies specified by law, are hereby expressly excepted from the jurisdiction of said Department.

SEC. 9. The Department of Highways shall have power to locate, construct, and maintain State Highways to the extent of the funds available; and to this end advertise for and let all contracts; purchase, equip, and operate the necessary quarries; and acquire such other property necessary for the construction and maintenance of the roads provided for. Whenever it shall become necessary to construct any part of the system of State Highways, as herein provided for, the cost of which exceeds five hundred dollars (\$500), the Department of Highways must have plans, specifications, and estimates prepared therefor in triplicate, and must advertise for bids for a period of two weeks in two papers of general circulation, which shall give the lowest rate for publication, published, one at the point nearest to where the work is to be performed, and one at the State Capital. Said advertisement shall be in the following form:

Department of Highways, Sacramento, Cal., ———, 18—.

Sealed bids will be received by the Department of Highways of the State of California, at its office in the State Capitol, Sacramento, until ——— o'clock, — M., 18—, for ——— in ——— County, California.

Plans and specifications for said work are on file in the office of said Department and in the office of the County Clerk of ——— County, at ———, Cal., to which bidders are hereby referred.

(Seal.)

—————,
Highway Commissioner.

Attest: ———,

Secretary.

REVIEW OF THE RESULTS OF ROAD EXAMINATIONS— RECOMMENDATIONS.

The former Bureau of Highways recommended to the Legislature of 1897 several laws and amendments intended to bring more system and economy into road work.

In brief, their recommendations were:

That the maximum rate of taxation prescribed by law for road purposes should be lowered from 40 cents to 35 cents per \$100 of assessed valuation;

That one half of this reduction, namely, $2\frac{1}{2}$ cents, should be relieved on all property within the State for the construction and maintenance of highways of State importance;

That the roads be classified according to their importance to the State, to the various counties thereof, and to the districts which they serve.

When the above measures came before the Legislature of 1897, the essential principles were entirely modified.

The law classifying roads was radically changed by the introduction of clauses which would permit of making unimportant roads State Highways, when they could never form the essential parts or links of a great highway system, and would furthermore place no limit on the mileage of such additions to the State's obligation. Recognizing the evil of these changes, the Executive wisely withheld his signature.

The recommendation to levy $2\frac{1}{2}$ cents tax for the construction of State Highways was also radically changed by extracting essential features and incorporating them in another bill, practically placing 85 per cent of that levy to the credit of the counties to be expended under and by county authorities—also, providing that State officials should indorse bonds issued by the counties, and in default of the counties paying the interest thereon, that the State should collect and pay such interest. These provisions we believe to be contrary to the plain provisions of Article IV, Section 31, of the Constitution, which prohibits the granting of the money or credit of the State to political

or other corporations or to persons. These measures failed to become laws, as did the previous mentioned bill.

The recommendation to reduce the maximum rate of taxation for road purposes from 40 cents to 35 cents was not considered by the Legislature, and instead of a reduction, the maximum was raised to 62½ cents per \$100 of assessed valuation.

An Act constituting Chapter CCLXIV of the Statutes and Amendments to the Code, 1897, was also passed during the last few hours of the session. It was generally known as the "Clark Road Law," and was never printed and submitted to consideration, nor was its existence known to the members of the Bureau of Highways. This law came before the Supreme Court in *Davis vs. Whidden*, 117 Cal. 618, and was declared illegal.

This, in brief, is the history of the first extended official attempt to institute system and economy into road work in this State.

The radical modification by the last Legislature of the laws recommended by our predecessors resulted in delay only, for the law continuing the work and investigations through this Department was approved, and the interest manifested in all parts of the State has increased.

Thus nearly all the road laws passed by the last Legislature were abortive, and attempts to effect reform were thwarted. The members of the Department believe that the principles of the laws recommended to the last Legislature were sound, but further inquiry convinces us that an important economy was not fully effected, namely: There are, and must continue to be, large expenditures by counties in road construction and maintenance, much of which is spent in temporary structures and patchwork, and we here outline the facts and the measures necessary to correct this waste.

The principles which should govern highway expenditures are as follows: It should be recognized at the outset that the main highways of the State and its counties are lines along which the travel and traffic of an indefinite future must move, and that it is therefore necessary to locate these lines on the most advantageous ground, irrespective of the temporary private interests, which at most can last for only one or two generations. After roads shall have been located upon these lines no false economy and makeshift methods should be allowed; the drains, culverts, and bridges should be made of masonry, and the roadbed graded to true lines and a sprinkling plant provided. Finally, the surface should be metaled with the best available rock. To attempt this upon all roads with the entire road fund of each county is not practicable. Existing roads, however bad, must be maintained so as to permit of reasonable use, even if this use temporarily entails heavy loss.

We therefore recommend that one-half of the road funds of each

county be set aside as a "Good Roads Fund," to be used as the necessities of the county may dictate, in permanent work in the order above outlined. It is entirely possible with the remaining half of the road fund to maintain existing roads in as good condition as they have been for some years past. Particularly is this possible if wasteful methods and political favoritism be set aside and system and economy instituted. Should this measure reduce the funds below the requirements of special local interests, the Boards of Supervisors have it in their power to levy for this purpose the special tax provided in Section 38, Chapter CCLXXVII, Statutes and Amendments of 1897. The setting aside of a portion of these funds for permanent work will be a means of bringing about this needed reform; but this cannot be accomplished by law alone. It is imperatively necessary that there should be integrity, intelligence, and energy on the part of the officials; and when these requirements are found in a County Surveyor and in members of the Boards of Supervisors, political faiths should not be considered.

The proposition above set forth is based on observations made in every county in the State, and borne out by the opinion expressed in the report of our predecessors, as follows:

"The existing roads should be maintained, through system and economy, with a sum not to exceed 75 per cent of the present rate of expenditure. It is the opinion of the Bureau *that even a less sum would be sufficient*. But granting the large sum as necessary would still leave 25 per cent of the sum expended during the last decade, or \$4,000,000, available for the systematic construction of permanent roads." (Page 22, Report of the Bureau of Highways.)

This Department therefore presents amendments to existing laws which prescribe that 50 per cent of the moneys now levied for road purposes under Section 2643 of the Political Code be set aside to be spent in permanent road work, as above outlined, the remainder to be expended in the maintenance of existing roads. It will be observed regarding this amendment: first, that the expenditure of county road funds is in no way removed from county officials, but that the half of these funds must be spent in permanent work; second, that an incentive to economy is made by the reduction of the fund which is available for patchwork; third, that every year during which this system is put in force it reduces the number of temporary structures requiring patchwork by replacing them with permanent masonry—these temporary structures, wooden drains, culverts, and bridges being the source of maximum expenditure for patchwork and repairs; fourth, during the last four years this system has been put into force in many counties, and they are actually following it to limited and varying extents in Yolo, Alameda, Napa, Santa Clara, Santa Cruz, Los Angeles, and other counties. In Yolo, for instance, the County Surveyor has built six bridges of a permanent

nature. The excellent example set by Napa County in stone and concrete bridges has been followed by other counties. In Los Angeles, one of the main roads through the county has been reconstructed under the supervision of the County Surveyor, and not a piece of timber was used. We therefore feel no hesitancy in urging this much needed economy.

EFFECT OF STATE EXAMINATION OF ROAD AFFAIRS.

If any definite fact is revealed by the road investigations which the State has caused to be made during the past four years, it is that there is and has been a lack of system and economy in road work. Even this examination has been the cause of correcting some of the evils which have grown up. Many of these have been the result of neglect, continued from year to year and from term to term until the proper methods of road work have been forgotten and ignored. This arises largely from a lack of technical knowledge of the details and cost of bridges, road machinery, classes of masonry, and the suitability of each class for special work in certain localities, utilization of rock for road surfacing, and even cost of earthwork. We find many instances where costly materials have been imported into the State, outside labor brought into the county to construct the work which should have been built of the imperishable materials abundant in the locality, and which could have been utilized by the resident laborers with but little technical advice and supervision. There is, again, a vast difference in the cost of work of the same class in the various counties. This is notably the case in bridge work, masonry of various kinds, and the efficiency of machinery and special appliances. These conditions can be remedied gradually and effectively by a dissemination of practical knowledge through a technical department maintained by the State. In the neglected state of road-building, and the lack of knowledge as to proper utilization of work and materials, the supplying of this knowledge is as much a duty of the State to its citizens as is the instruction it so generously and wisely provides for its youth.

There must therefore be, not only an effort on the part of the people and by the County Surveyors and Boards of Supervisors, but a sustained determination on the part of the State to place at the service of these officers the highest technical skill. This can best be done through a department of the character recommended to the Legislature of 1897.

OCCURRENCE OF ROAD-BUILDING MATERIALS.

There is an abundance of materials occurring over the entire State of California which can be utilized with great benefit to economic road maintenance. In almost every county adequate materials exist, which,

if utilized with skill and judgment, will give our State highways of unsurpassed excellence. The failures to utilize these materials have been due in part to a lack of knowledge as to their character, and of technical skill as to the mode of using them.

All the hard silicious rocks, such as chert, jasper, quartz, quartzite, etc., the volcanic rocks (trap and basalt), and a wide series of metamorphic rocks occur abundantly in our State. In addition, bowlders, cobbles, and gravel of miscellaneous composition, but exceedingly hard and durable, are scattered over great areas. Hard limestone and some of the silicious shales occur in many counties. Occurring with these rocks are others which are inferior or useless for road-surfacing. Many instances of failure in the use of rock have been due to the selection of the wrong material. Again, the proper selection has been made, but the materials have not been properly utilized. The best rock roughly cracked up and dumped over a road will no more make a road surface than shingles dumped on a shed and scattered with a rake will make a roof.

The best rock must be selected, properly crushed and screened, and then spread, sprinkled, and rolled in layers over a well-graded and drained surface. The utilization of our wealth of road-building materials will only be accomplished when a better knowledge of their occurrence and modes of utilization shall be disseminated through the State. In the former report our predecessors called attention to the occurrence of rocks and materials suitable for road-building in each county. This Department has continued this work, and has pointed out to county authorities, whenever possible, the correct mode of utilizing rock, sand, and alkaline clays, etc. In one county we found an excellent binding material, a soft limestone, being hauled a considerable distance, and used almost alongside of the hardest and most durable chert, with which a small proportion of the limestone should have been used as a binding or cementing material. This would have given a better and more durable road surface and saved the long haul from the limestone quarry of nine tenths of the stone used.

It would be of no service to write the numerous localities examined in each county. In no county are suitable materials lacking, even in the valley counties; sand can be hauled and mixed with the alkaline adobes, or alkaline adobes can be hauled and mixed with the sand of the wide reaches of sandy soil which occur, as in Stanislaus or Merced. Either process will yield a road material of fair quality. Again, the hardpan of many counties, when allowed to disintegrate, and then spread, sprinkled, and rolled, makes a fair road surface. Again, it must be constantly borne in mind that the use of rock, sand, and gravel should not be limited to the road surface. Wood is not a proper material to use in any part of a road or road structure. Its use should be limited to

stakes to mark alignments and grades, and, in special instances, for bridge floors. To use it for drains, culverts, and bridges is an absolute waste.

It rarely becomes necessary to build a drain or culvert in any part of the State that the bulk of the materials to build it of is not close at hand. In the mountain and foothill counties abundant rock suitable for masonry or for concrete is generally found. In the valley counties, sand, gravel, or broken rock can generally be obtained. These, with cement and a little common sense and ingenuity, can be made into abutments, piers, culverts, and drains of great durability. The only skilled labor required is a good foreman and a carpenter to make the temporary timber forms. The County Surveyor can, in most counties, save the taxpayers many dollars and keep the money at home in the construction of a large proportion of the substructures, besides adding wealth to the county by putting up structures which will require no more expenditure for centuries.

We append a photograph of a small culvert built, under the supervision of this Department, of a ledge of rock which was an obstruction to the road for forty-nine years.

TABLE NAMING SOME OF THE ROAD-BUILDING MATERIALS OCCURRING
IN EACH COUNTY.

Alameda	Chert, limestone, basalt, trap, and metamorphic rock; abundant gravel.
Alpine	Basalt, silicious and metamorphic rocks abundant.
Amador	Boulders, cobbles and gravel, limestone, basalt abundant.
Butte	In mountainous portions a great variety of excellent materials; in valley portions alkaline clays, gravel, sand.
Calaveras	Basalt, limestone, cobbles, boulders, etc., abundant.
Colusa	Basalt, lava, gravel, sand, alkaline clay, hardpan.
Contra Costa	Basalt, limestone, chert, jasper, abundant gravel, silicious shale.
Del Norte	Boulders and cobbles, silicious and metamorphic rocks, gravel.
El Dorado	Volcanic and metamorphic rocks, basalt, limestone, abundant.
Fresno	In the valley portion, gravel, hardpan, sand, clays; in mountain portion, volcanic rocks abundant.
Glenn	In the valley portion, gravel deposits abundant; trap, basalt abundant in foothills and mountains.
Humboldt	Gravel in valleys; trap, basalt, limestone, boulders, and cobbles abundant; asphaltum.
Inyo	Silicious and volcanic rocks abundant; gravel and alkaline clays.
Kern	Bitumens, asphalts, clays and adobes, sand, volcanic and metamorphic rocks abundant.
Kings	Asphalts, volcanic rocks in southwest portion, clays and sand.
Lake	Trap, basalt, silicious shales; gravel abundant.
Lassen	Basalt and other volcanic rock; limestone, gravel, abundant.
Los Angeles	Disintegrated granite, limestone, gravels, cobbles, clays.
Madera	Gravel in limited quantity in the valley; alkaline clays and adobes, sand; in mountains volcanic rock abundant.
Marin	Basalt, trap, gravel; metamorphic rocks abundant.
Mariposa	Quartzite, volcanic rocks, gravel; metamorphic rocks abundant.
Mendocino	Abundance of excellent materials; basalt, trap, silicious shale, etc

SOME OF THE ROAD-BUILDING MATERIALS OCCURRING IN EACH COUNTY—Continued.

Merced	Sand, alkaline clays, and adobes; gravel.
Modoc	Basalt and trap abundant.
Mono	Metamorphic and silicious rocks abundant.
Monterey	Bitumen, limestone, gravel.
Napa	Basalt and other volcanic rocks; gravel, silicious shales abundant.
Nevada	Road-building material abundant and in great variety.
Orange	Gravel, asphalt.
Placer	Basalt, trap, limestone, silicious shale; bowlders and cobbles abundant.
Plumas	Volcanic and metamorphic rocks abundant; gravel, silicious shale.
Riverside	Porphyry, limestone, disintegrated granite, metamorphic rocks.
Sacramento	Cobblestones and bowlders; gravel abundant.
San Benito	Silicious shale, volcanic and metamorphic rocks, limestone abundant.
San Bernardino	Limestone, bowlders, gravel, ferruginous clay.
San Diego	Cobbles and gravel, bowlders, limestone, basalt, trap.
San Francisco	Chert, jasper.
San Joaquin	Volcanic rocks, gravel, alkaline clays and adobe, sand, hardpan.
San Luis Obispo	Bitumen, asphalt, trap, silicious shale, chert, gravel, disintegrated gravel.
San Mateo	Chert, excellent and abundant; limestone, bowlders, jasper.
Santa Barbara	Cobbles and bowlders, limestone, bitumen, asphalt.
Santa Clara	Gravel abundant, asphaltum, volcanic and metamorphic rocks, jasper, silicious shales.
Santa Cruz	Volcanic and metamorphic rock, bitumen rock, gravel.
Shasta	Gravel, bowlders, cobbles in western part; volcanic rocks abundant in eastern part.
Sierra	Volcanic and metamorphic rocks, cobbles and bowlders; gravel abundant.
Siskiyou	Trap, basalt, quartzite, limestone abundant.
Solano	Basalt of excellent quality, gravel.
Sonoma	Basalt and trap abundant; gravel, cobbles, and bowlders.
Stanislaus	Gravel abundant; alkaline clays, sand, hardpan, bowlders, cobbles.
Sutter	Clays and adobes, sand, cobbles and bowlders, volcanic and metamorphic rocks.
Tehama	Basalt, trap, cobbles, bowlders, gravel abundant.
Trinity	Volcanic and metamorphic rocks and bowlders abundant.
Tulare	Alkaline clays and adobes, sand.
Tuolumne	Quartzite, volcanic and metamorphic rock of excellent quality and abundant.
Ventura	Cobbles, gravel, asphalt, bitumen, limestone, silicious shale.
Yolo	Gravel, cobbles, and bowlders.
Yuba	Volcanic and metamorphic rocks; cobbles and gravel abundant.

NOTE—This table is by no means exhaustive, but is intended more to call attention of county authorities to the matter, in order that a close examination may be made of each county.

CONNECTING COAST ROAD BETWEEN SANTA CRUZ AND SAN MATEO COUNTIES.

A road along the coast around New Year Point has long been desired. Its construction was postponed from year to year from an exaggerated idea of its cost; even a road wide enough for a wagon to pass was thought too costly. The subject was referred to this Department by the Supervisors of Santa Cruz County, and Commissioners Ashe and

Price made a preliminary examination and report upon the subject, placing the estimated cost at a figure far below that previously accepted. The County Surveyor was subsequently directed to make a survey and specifications. Upon this report a contract was awarded for less than the estimate made by this Department, and the road satisfactorily constructed. Previously travelers had to risk driving along the beach at high tide around a very dangerous point.

ROAD FROM NEWMAN, IN STANISLAUS COUNTY, TO SAN JOSÉ.

A proposition to construct a road from Newman to San José has been considered for some time by the citizens of the two counties. The matter was urgently brought before the Department by public-spirited citizens at both ends of the proposed road, and in compliance with their request the Commissioners examined possible routes for such road. The most desirable route lies up Orestimba Creek, crossing the Coast Range at a low point at its head, and descending into the valley of San Antonio Creek. This route possesses the advantage of connecting westerly with the roads of Santa Clara County leading to Alviso and San José, via Smith Creek, and northwesterly with the roads of Alameda County, via San Antonio Creek.

THE SACRAMENTO AND FOLSOM ROAD.

The Legislature of 1897 provided for the construction of a model highway from Sacramento to Folsom, along the lines of a portion of Highway No. 6 of the Act to classify the roads of the State. The main provisions of this Act were that the State should furnish, from the quarries at the State Prison at Folsom, the crushed rock, dimension stone for bridges and culverts, and rock for drains; and that after construction it would assume the maintenance of the road. No money was appropriated for grading, transportation, labor, etc.—this being left to the County of Sacramento. The work was to be performed under the direction of a non-technical commission, with general powers not well defined in the law. The Department undertook to join in the necessary engineering work and to present the matter in full to the citizens of Sacramento County and its Board of Supervisors. We therefore submitted the legal questions involved to the honorable the Attorney-General, and were advised by him that bonds could be issued by the county upon a two-thirds vote of the citizens of the county, including municipal residents. We were informed by the Board of Supervisors of Sacramento County that there were no funds available for meeting the expenses of construction and transportation.

Acting upon the above opinion, the Board of Supervisors called an election upon the proposition of issuing \$75,000 in 4 per cent bonds to meet the cost of constructing this road.

The members of this Department therefore presented the subject in full to the citizens of the county at nearly every important precinct and in the City of Sacramento. Attention was particularly called to the provisions of the law, which were practically State aid to road construction, by the furnishing of material and the subsequent assumption of the cost of maintenance. The results of the election were as follows:

In the county	for, 1,220; against, 427; majority for, 793
In the city	for, 3,832; against, 343; majority for, 3,489
Total	for, 5,052; against, 770; majority for, 4,282

Bids for the bonds were received greatly in excess of the necessary amount—the best bid being considerably above the par value.

It will be observed that the idea of State aid, although coupled with the generally objectionable project of a bond issue, proved popular and acceptable, not only to the people of the county, but particularly so to the citizens of the City of Sacramento, who, under the provisions of the law of 1883 (Stats. 1883, p. 20) are exempt from direct taxation for road purposes.

The sale and issuance of the bonds were prevented by the institution of a suit to declare the proposed issuance and sale illegal. The Supreme Court upheld this contention (*Devine vs. Sacramento County*). The work was therefore abandoned.

This is to be regretted, for it deprived the State of the object lesson in road work which was intended, and in a measure proved another setback to much-needed corrections in road methods.

AMADOR COUNTY ROADWORK.

During the fall and winter of 1897-98 this Department was in consultation with the Board of Supervisors of Amador County regarding improving the important highway between Ione and Jackson. Later, we made surveys and estimates of the cost of improving a portion of this road to the full extent of the funds available. Acting in conjunction with the County Surveyor, one or the other of the Commissioners, and particularly Commissioner Ashe, was constantly on the ground during several months. There were several small ledges of rock near Martel's Station which have always been dangerous and objectionable. These were quarried out and the stone used to construct culverts—photographs of which are appended as types of a class of work much needed in the State.

Although the work was prosecuted with inferior tools and plant, and



STONE CULVERT ON IONE AND JACKSON ROAD, BUILT BY THE DEPARTMENT OUT OF A LEDGE
WHICH HAD OBSTRUCTED THE ROAD FOR FORTY-NINE YEARS. COST \$120.



TEMPORARY AND COSTLY CULVERT. TYPE OF STRUCTURE TO AVOID.

during an exceptionally dry season, the cost was less than any of the bids therefor.

Full data and details of the work are on file in this office.

SAN MATEO COUNTY BOND ELECTION.

It was found by an examination of road conditions in San Mateo County that the county was expending about \$60,000 upon roads each year. A very large portion of this amount is expended in the expensive maintenance of temporary structures and badly drained and metaled roadways traversing the county along lines of maximum travel. In conference with some of the leading citizens, it was deemed advisable to submit the following proposition to the people: To set aside a portion of the existing road tax as an interest and sinking fund for forty years, and to issue $4\frac{1}{2}$ per cent bonds for \$310,000, the fund raised by the sale of these bonds to be used in reconstructing the two main highways, and by the substitution of light grades, permanent structures and macadamized road surfaces, to reduce the cost of maintenance.

The Board of Supervisors agreed to the above outlined plan, and submitted the matter to an election. The result was:

Votes for bonds	549
Votes against bonds	1,035
Majority against bonds	486

There were several active causes which were brought to bear against road improvement, and the question was probably not thoroughly understood. But the decisive vote against the proposition, when compared with the vote in Sacramento County, shows the effect of State aid in advancing highway construction.

CAPITALIZATION OF ROAD FUNDS.

In many counties it is desirable to capitalize a portion of the road tax, and to set apart such portion as an interest and sinking fund for the redemption of bonds. This would enable a county to issue quite a large bonded indebtedness and to reap the benefit of permanent road construction without increasing its tax levy for road purposes beyond the limit now fixed by law. This can be made apparent by an illustration: Let the assessable property of a county be \$10,000,000. This, at 40 cents on the \$100, will yield \$40,000 per year for road purposes. If one half of this be capitalized at 4 per cent, it will permit of the issuance of bonds to the amount of \$400,000 and pay off interest and capital in forty years, giving the county the advantage of concentrating \$400,000 on its roads without increasing its rate of taxation and having the use of per-

manent roads and the enhanced valuation of property due to improved road conditions.

We therefore recommend that Boards of Supervisors be authorized by proper vote, as prescribed by law, to thus capitalize a portion of the road fund, provided that the road tax and the tax for an interest and sinking fund shall not exceed the maximum rate of 40 cents on the \$100, as now provided by law.

THE PRESTON SCHOOL OF INDUSTRY.

This Department was called on to relocate the roads and drives through the grounds of the Preston School of Industry, and to locate and stake out the buildings and extensions provided for by law. This work was prosecuted during intensely hot weather, using as far as possible the boys and practically instructing them in the work.

The Department has also been called upon in reference to extending and improving the water supply, which in certain requirements has not proved satisfactory.

We take pleasure in expressing appreciation for the courteous coöperation of the officers of that institution.

EXAMINATIONS OF THE YOSEMITE VALLEY.

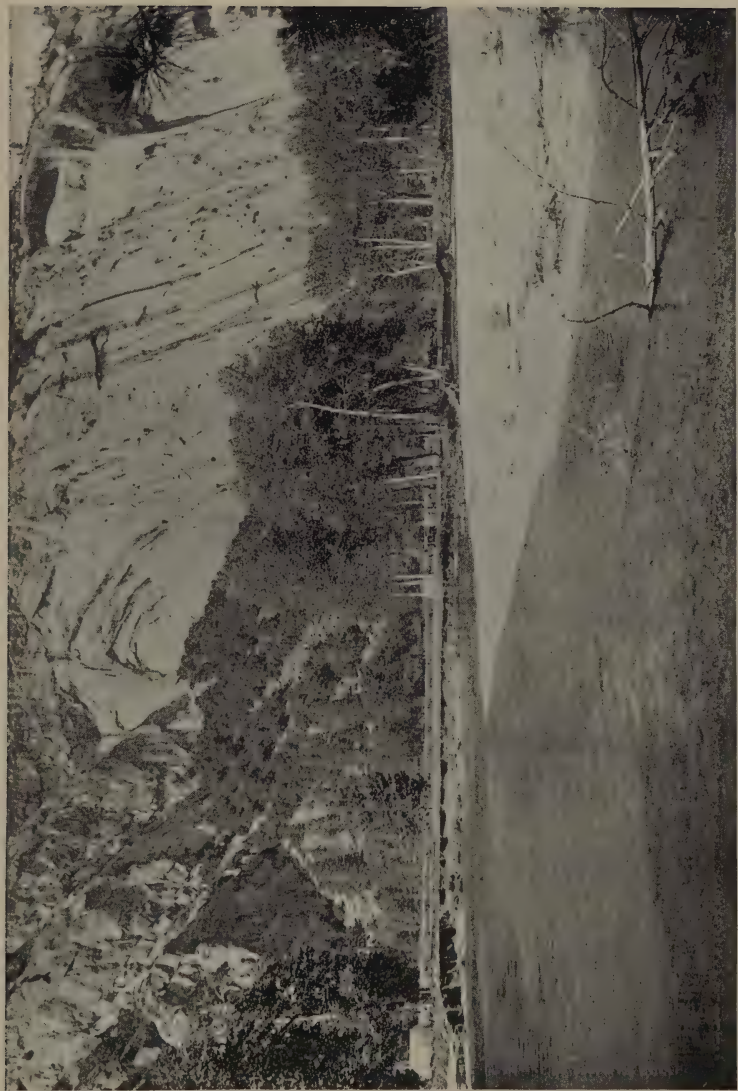
The Yosemite Valley Commissioners requested this Department to make certain examinations and estimates regarding sprinkling the roads and protecting the banks of the river.

This work was done and the following general recommendations were made:

The sprinkling can be most economically done by an improved sprinkling wagon supplied from a system of tanks delivering water at proper intervals along the main roads. Owing to the severity of winter weather, the tanks and pipes should be emptied each autumn. The tanks should be of concrete, masked by rustic stone or concealed entirely from view in native shrubbery and vines.

A second system upon which the first outlay would be less, is a tank wagon carrying a rotary pump and a gasoline engine capable of driving the wagon, and which would be filled at convenient localities. Various manufacturers were consulted regarding such a plant, but none could furnish it in time for the season's travel in the valley, nor were they inclined to incur the expense of the very definite mechanical studies which would have to be made in designing such a plant.

Other methods were suggested and studied, but one or the other of the two above mentioned is considered more desirable. The former would be cheaper to operate and the latter in first cost. This Depart-



BANK DESTRUCTION IN YOSEMITE VALLEY. THE SAND AND GRAVEL BAR ON THE RIGHT IS REPLACING THE MEADOW LAND ON THE LEFT.



MERCED RIVER, IN YOSEMITE VALLEY, SHOWING BANK DESTRUCTION AND LOSS OF VALLEY LANDS.

ment recommends the latter, and that \$20,000 be made available for the purpose of sprinkling the roads, and authorizing the Yosemite Valley Commission to execute such plan as may be deemed by them to the best interests of the State.

The destruction of the banks of the river through the valley is becoming more and more serious. The Guardian has been able to do only such work as the very limited funds at command would permit.

We append several photographs which show the magnitude of the damage which is being done. It must be systematically checked by permanent stone riprap along the banks at exposed or threatened places. The work must extend over many years, but should be at once inaugurated, preferably at the lower end of the valley, by cleaning the bed of the river of snags, trees, and large boulders, and by thorough riprap work on the banks. In a few instances the gravel and cobble bars should be scraped away at extreme low stages of the river. A careful instrumental survey of the banks and channel should be made as a basis for future systematic protection and rectification. This Department recommends that at least \$4,000 per year be made available for this purpose, and that the work be systematically carried on until the concave banks be thoroughly and permanently protected with rock—brush in this class of work not being efficient nor permanent.

ECONOMIC ROAD-BUILDING.

Elsewhere in this report attention is called to the lack of system and economy which has prevailed in the expenditure of road funds. In this chapter it is intended to specifically point out one of the most important lines along which system and economy can be introduced—namely, in building and maintaining bridges. The gross amount of money invested in highway bridges in this State foots up into the millions. These have been so constructed that their maintenance is one of the severest taxes put upon the road funds of the several counties, and in the application of sound business principles to this branch of highway work the greatest saving can be effected.

The prime reasons why bridge building and maintenance are so costly, are: First, in many instances the bridges cost more than they should, because the county officials do not know their actual cost; and, secondly, a lack of technical skill in the matter permits the use of the wrong materials.

Bridges, which should be of masonry, are built of very perishable timber, the constant renewals of which exhaust the road funds.

The raising of about \$2,000,000 per year for highway purposes is equivalent to a tax levy of 20 cents per \$100 on one billion dollars. This amounts to \$80,000,000, in forty years, which sum, intelligently

and honestly expended, will give California a magnificent system of highways. But it requires the introduction of system, skill, and integrity in every detail. But if the present system be continued, the full benefit of the expenditure of this vast sum will be far from being realized.

In some counties the interest in road work has been so fully aroused that permanent substructures of masonry are gradually being introduced, and in some, such as Napa or Solano, it would be next to the impossible to return to timber culverts and bridges. But in the great majority of counties, timber is looked upon as the proper material to build bridges of, even though excellent materials for some form of masonry exist close at hand. This is even true in the case of some steel bridges.

There is appended a table giving the moneys expended for lumber and labor thereon in the counties named.

BRIDGES AND CULVERTS.

Expenditures for Eight Years—From January 1, 1890, to January 1, 1898.

County.	Lumber.	Bridge Work.	Total.	Probable Cost.
Alameda	\$49,206 00	\$164,654 00	\$213,860 00	\$213,860 00
Alpine				
Amador				
Butte				
Calaveras	4,684 00	34,155 00	38,839 00	38,839 00
Colusa	36,056 00			72,618 00
Contra Costa	36,309 00			72,618 00
Del Norte				
El Dorado	2,668 00	8,598 00	11,266 00	13,934 00
Fresno	82,380 00	14,269 00	96,649 00	179,029 00
Glenn*	16,725 00	79,286 00	96,011 00	112,736 00
Humboldt		38,220 00	38,220 00	38,220 00
Inyo				
Kern	18,314 00	29,926 00	48,240 00	66,554 00
Kings*	7,605 00	754 00	8,359 00	15,964 00
Lake	11,224 00	6,319 00	17,543 00	28,767 00
Lassen				
Los Angeles	29,573 00	88,455 00	118,028 00	147,601 00
Madera*	9,376 00	1,013 00	10,389 00	19,765 00
Marin	9,842 00		9,842 00	19,684 00
Mariposa		8,167 00	8,167 00	8,167 00
Mendocino	47,535 00	56,465 00	104,000 00	151,535 00
Merced	31,317 00	25,122 00	56,439 00	87,756 00
Modoc				
Mono				
Monterey	27,206 00	28,011 00	55,217 00	82,423 00
Napa	8,891 00	51,197 00	60,088 00	68,979 00
Nevada	4,162 00	49,576 00	53,738 00	57,900 00
Orange	18,014 00	2,858 00	20,872 00	38,886 00
Placer	22,017 00	59,742 00	81,759 00	103,776 00
Plumas				
Riverside*	3,150 00	5,932 00	9,082 00	12,190 00
Sacramento				
San Benito	7,419 00	12,724 00	20,143 00	27,562 00
San Bernardino	7,607 00	102,696 00	110,303 00	117,910 00
San Diego	15,551 00	15,553 00	31,109 00	46,660 00
San Francisco				
San Joaquin	17,435 00	72,021 00	89,556 00	106,891 00
San Luis Obispo	13,105 00	7,217 00	20,322 00	33,427 00

BRIDGES AND CULVERTS—Continued.

County.	Lumber.	Bridge Work.	Total.	Probable Cost.
San Mateo	\$41,930 00	-----	\$41,930 00	\$83,860 00
Santa Barbara	23,022 00	\$21,837 00	44,859 00	67,981 00
Santa Clara	45,463 00	72,499 00	117,962 00	163,425 00
Santa Cruz	35,402 00	21,266 00	56,668 00	92,070 00
Shasta	6,261 00	66,653 00	72,915 00	79,175 00
Sierra	-----	-----	-----	-----
Siskiyou	-----	-----	-----	-----
Solano	50,824 00	11,307 00	62,131 00	112,955 00
Sonoma	16,193 00	-----	16,193 00	32,386 00
Stanislaus	19,696 00	155,509 00	185,205 00	194,901 00
Sutter	26,774 00	26,774 00	53,548 00	53,548 00
Tehama	14,869 00	49,845 00	64,036 00	79,583 00
Trinity	-----	-----	-----	-----
Tulare	39,239 00	27,356 00	66,595 00	105,834 00
Tuolumne	3,385 00	13,552 00	16,937 00	20,322 00
Ventura	17,208 00	10,348 00	27,556 00	44,764 00
Yolo	41,072 00	44,941 00	86,013 00	127,085 00
Yuba	18,383 00	49,845 00	68,228 00	86,611 00
Totals	\$944,092 00	\$1,590,898 00	\$2,308,717 00	\$3,338,751 00

* Since organization.

The first column shows the amount of money expended for lumber, much of which goes for box drains and culverts, and is drawn largely from the county general fund. The second column shows the cost of labor, and the last, the total sums spent. These figures are separated from the road expenditures only with great difficulty. The system of road accounts is so incomplete and vague that it is hardly possible to trace the sums. In some counties the reports of the road commissioners are not classified, nor are the bills verified; the monthly or quarterly reports show that certain individuals were paid certain sums, but what the money was paid for it is difficult or impossible to determine. Hence, it is not possible to correctly classify road expenditures.

To correct this condition of affairs, it is necessary to call in some official whose business it is to know more about bridge-building, the economic use of materials, their strength and cost, than the Boards of Supervisors—for, however broad may be their general knowledge and experience, their business training is not such as to develop that skill which it is the business of an engineer to acquire. Consequently, they are frequently misled in the selection of materials and in the cost of highway structures.

In order to bring out the real state of facts, we subjoin the following table, showing the cost of the principal bridges in the counties named:

BRIDGES IN CALIFORNIA.

County.	Span.	Road	Foundation.	Con- structed	Cost.	Remarks.
Butte	150' com.			1888	\$6,350 00	
"	50' steel	20'	Con. abut.		3,000 00	Four built beams
El Dorado	85' com.	14'	Stone	1898	1,400 00	Combination
Glenn	1,100' com.	16'	Cyl. piers	1895	18,900 00	Com. truss
"	150' com.	18'	Stone abut.	1893	11,475 00	Steel truss
"	190'		Stone and cyl.		4,597 00	Com. truss
"	59' 6"	18'	Cyl. piers			Com. truss
"	40'	18'	Cyl. piers		5,273 00	Com. truss
"	40'	18'	Cyl. piers			Com. truss
Kern	144'	16'	Pile bridge	1894	1,542 00	Wooden pile
"	2,020'	20'	Pile bridge	1894	4,100 00	Wooden (part) pile
"	240'	16'	Pile bridge	1894	1,590 00	Wooden pile
Los Angeles	48'	20'	Pile bridge	1890	408 00	Wooden pile
"	48'	20'	Pile bridge	1890	384 00	Wooden pile
"	780'	18'	Cyl. piers	1890	5,662 00	Combination
Nevada	104' 3", 40' app.	12'	Cyl. piers	1893	5,893 00	Steel
"	60'	10'	Cyl. piers	1895	1,725 00	Steel
"	100'	14'	Cyl. piers	1895	2,650 00	Combination
"	144' 8", 48' app.	18'	Cyl. piers	1895	8,787 00	Steel Pratt
"	105'	16'	Cyl. piers	1894	4,895 00	Steel Pratt
"	65'	12'	Cyl. piers	1896	1,690 00	Steel Pratt
"	150'	16'	Cyl. piers	1897	7,163 00	App. built
"	126'	14'	Con. abut.	1898	6,248 00	Stone abut. Very little expense.
"	32'	15'	Cyl. girders	1898	2,294 00	Con. abut.
Napa	3 spans, 55', 212' over all	20'	Stone		14,500 00	All stone
"	3 70' arches	20'	Stone		19,980 00	All stone
"	1 30' arch	20'	Stone	1896	3,327 25	All stone
Sacramento	2 spans, 110' ea.	20'	Cush. piers	1897	7,594 00	Steel Pratt; 240' over all. (Con.)
San Diego	5 100' spans	18'	Pile	1895	4,856 00	Combination
Sierra	150'	12'	Cyl. piers	1895	5,570 00	Steel Pratt and wood app. of 80 ft.
San Joaquin		20'	Draw	1891	37,897 00	Steel draw with app's.
Santa Cruz	100'	20'	Con. abut.	1898	3,197 00	Steel Pratt
Shasta	4 spans, 115', or 460' over all	16'	Cyl. piers		23,647 00	Steel Pratt
"	117' steel span, 150' app.	14'	Cyl. piers		6,280 00	Steel Pratt and wood.
Tehama	2 spans, 65' and 40', with 40' ap.	16'	Cyl. piers	1893	3,310 00	Steel Pratt and wood.
"	2 spans, 130', and 60' app.	18'	Cyl. piers	1893	13,000 00	Steel Pratt; 320 ft. over all.
"	120'	18'	Cyl. piers on piles and con. abut.	1897	1,707 00	Steel Pratt
Tulare	96'	20'	Pile	1891	7 25	per ft.
"	3 spans, 100' ea.		Pile	1892	4,600 00	Pile bridge
"	150'		Cyl. piers	1893	2,189 00	Wood truss
"	3 spans, 100' ea.		Cyl. piers	1893	4,805 00	Combination
"	100'		Cyl. piers	1897	1,500 00	Truss
Yolo	2 spans, 90 ea., 40' app.	20'	Cyl. piers	1896	2,881 00	Combination
"	120'	20'	Cyl. piers	1896	2,426 00	Com. (Built by Co. Surveyor).
"	120'	20'	Cyl. piers and app.	1896	2,996 00	Steel Pratt (Co. Sur)
"	60'		Cyl. piers	1895	939 15	Steel pony truss (built by Co. Sur.)
"	75'	20'	Cush. piers	1894	2,543 00	Steel Pratt (Con.)
"	2 spans, 100' ea.		Cyl. piers	1895	5,900 00	Combination (Con)
"	100'		Cyl. piers	1895	2,560 00	Combination (Con)
"	100'		Cyl. piers	1895	1,685 00	Com. (Co. Sur.)



DIAGRAM SHOWING COMPARATIVE COST AND SIZE OF BRIDGES BUILT IN YOLO COUNTY. SMALL SPAN IN DOTTED
 LINES, BUILT BY CONTRACT, COST \$2,543, SUPERINTENDENCE AND INSPECTION NOT INCLUDED. LARGE SPAN
 IN FULL LINES, BUILT BY COUNTY SURVEYOR BY DAY'S LABOR, COST \$2,418 68 COMPLETE, INCLUDING
 ABUTMENTS.



COSTLY TYPE OF BRIDGE OVER FARM LAND. NO WATERWAY WITHIN SEVERAL HUNDRED YARDS OF THIS
END. SUCCESSIVE SPANS OF THIS BRIDGE HAVE COST YOLO COUNTY MANY THOUSANDS OF DOLLARS.

A study of this table reveals some important economic facts, which it will be well to bear in mind:

First—There is a great variation in the cost of these structures, which cannot be accounted for by differences in prices of materials, labor, or transportation.

Second—Where trained technical skill has been employed by the county the cost has been reduced by more than one half.

We will first consider wooden structures, or what are known as combination trusses.

A combination Pratt truss consists of wood and iron or steel. The members sustaining or subject to a pulling force are steel, and all members subject to compression are of wood.

We give, herewith, some photographs of this class of bridges.

One of these bridges, consisting of two spans, 90 feet each, with 40 feet of approach, was constructed for Yolo County by the County Surveyor, for the sum of \$2,881. The bridge rests on steel cylinder piers of 3 feet diameter, filled with concrete, and sunk to a solid foundation. This, we will observe, is \$1,440 50 for a 90-foot span and 20-foot approach. The bridge has a 20-foot roadway, and is in every respect a model of its kind. This bridge was constructed in 1896. In 1895 it cost Yolo County \$5,900 to construct two spans of 100 feet each over Cache Creek, the same being built by contract. It rests on a cylinder pier, the same as the one constructed by the County Surveyor, but cost \$2,950 for 100 feet of bridge. It cost \$2,560 to construct a 100-foot span immediately adjoining the two spans above described. Later, the County Surveyor constructed, with a local contractor, a span of the same length, namely, 100 feet, and immediately adjoining the three-span above described, for the sum of \$1,685.

In Butte County it cost \$6,350 for a combination bridge of 150-foot span.

It cost Nevada County \$2,650 for a 100-foot span combination truss, 14-foot roadway, constructed in 1895.

San Diego County constructed five spans, 100 feet each, for \$4,855, on a pile foundation, or at the rate of \$971 per 100 feet, with an 18-foot roadway.

Tulare County constructed a combination bridge of 150-foot span for \$2,189, resting on cylinder piers, and a bridge of 110-foot span, same class, for \$1,500.

It cost, therefore, for 100 feet of this class of bridge in Yolo County, when built by the County Surveyor, \$1,685. In Nevada County a lighter bridge, constructed by contract, cost, for same span, \$2,650. We can see no reason for this wide difference in cost of duplicate bridges in Yolo County and in Nevada and other counties, unless we attribute it to the want of knowledge of this character of work.

STEEL BRIDGES.

If we examine the above table we see that it costs in Yolo County, under the supervision of the County Surveyor, \$2,426 11 to construct, complete and ready for use, resting on concrete cylinder piers, a steel Pratt truss bridge with a roadway 20 feet in the clear, calculated to sustain a live load of 1,600 pounds per lineal foot.

We give, for the information of the public, the cost of this structure by items, as kindly furnished by the County Surveyor who constructed the bridge in 1896 :

Steel frame and cylinders	\$1,475 00
Lumber	327 21
Cement	89 00
Store bills	18 65
Blacksmithing	1 75
Use of jackscrew	1 00
Labor, plans, and superintendence	513 50
Total	<u>\$2,426 11</u>

A steel bridge of 60-foot span, 18-foot roadway, with 1,600 pounds capacity, resting on cylinder piers filled with concrete, constructed also by the same official, cost as follows:

Steel and freight	\$557 32
Store bill	7 44
Cement	95 00
Lumber	135 09
Total cost of material	<u>\$794 85</u>
Cost of labor	144 30
Total cost of bridge	<u>\$939 15</u>

In Nevada County, as shown in the table for the cost of steel bridges, we will take as an example the bridge with a span of 126 feet, a roadway of 14 feet in width. This bridge will carry 1,400 pounds per lineal foot for live load, and is a much lighter bridge in every respect than the 120-foot bridge of Yolo County. The bridge rests on a natural stone abutment on the north end, and on a concrete abutment of 10 or 12 feet in height on the south end. We cannot figure more than 50 cubic yards of concrete in the abutments, and this, at \$8 per cubic yard, would cost \$400 to put in place. The bridge was constructed during the present year in the dry season. Certainly, the actual cost of this structure could not have been more than \$2,500, and yet the price paid for the same by Nevada County is \$6,248.

The other bridges in Nevada County show a marked excess of cost over those lately constructed in Yolo County. This difference cannot be accounted for except through the wisdom of the Board of Supervisors of Yolo County in turning over the work of bridge-building to the



ONE OF THE YOLO COUNTY BRIDGES. BUILT BY THE COUNTY SURVEYOR, AT A GREAT
SAVING TO THE COUNTY.



County Surveyor, an engineer of skill and integrity. We cannot refrain from calling attention to the fact that this official has not only saved the county several thousands of dollars, but he was renominated by one of the great political parties and indorsed by the other.

A further comparison in costs of steel bridges is made in the case of the Downieville bridge, in Sierra County, 75 miles above Marysville. This bridge was built in 1895, for \$5,570. The steel span is 150 feet long, with a roadway of 12 feet. It rests on 30-inch steel cylinders, 9 feet above the bed of the stream. The approaches are 80 feet in length. All of the material was transported from the latter place to its destination, over a rough mountain road with steep grades, yet this bridge cost less money than the bridge of 126-foot span, with no approaches, in Nevada County.

The bridge at Purdon's Crossing, over the South Yuba River, in Nevada County—one steel span 144 feet 8 inches in length, with 24-foot approach on each end, and 18-foot roadway, resting on cylinder piers—cost \$8,787. If we allow \$8 per foot for approaches, the steel span in the Downieville bridge would cost \$5,570, less \$640, or \$4,930. The Purdon Crossing bridge proper cost \$8,787, less \$384, or \$8,403, which is \$3,473 more than the steel span at Downieville. It is true that the bridge at Downieville is lighter and has a narrower roadbed, but we can see no reason for a difference in cost of \$3,473.

Again, in Shasta County, in 1893, a steel bridge was constructed consisting of two spans of 130 feet each, with 60 feet of approach, for the sum of \$13,000. The bridge has a roadway of 18 feet in the clear, resting on cylinder piers, two of which are composed of two cylinders 36 inches in diameter, and one, the center pier, two cylinders 48 inches in diameter. Allowing for 30 feet of approach \$240, each steel span cost that county \$6,260, which is excessive. The bridge is light in its parts, with a capacity of 1,200 pounds per lineal foot.

It cost Sacramento County \$7,594 to construct a steel bridge, consisting of two spans of 110 feet each, over the Cosumnes River, in 1897. This bridge has a 20-foot roadway, is resting on Cushing piers, and has a capacity of 1,600 pounds per lineal foot. This cost does not include the approaches. Each span and its supports, therefore, cost \$3,797. This bridge is less costly per lineal foot than the bridges in Nevada County, and more costly than work of a similar class on the opposite side of the river in Yolo County, constructed under the direct supervision of the County Surveyor. In this latter county the work actually cost \$2,426 11, or \$1,370 89 less per span of 120 feet than in Sacramento County. It is true that in this latter county the piers were most costly.

Santa Cruz County has recently let a contract for the construction of a steel bridge of 100-foot span, near the town of Watsonville, for \$3,797. This contract includes the building of concrete abutments and the filling

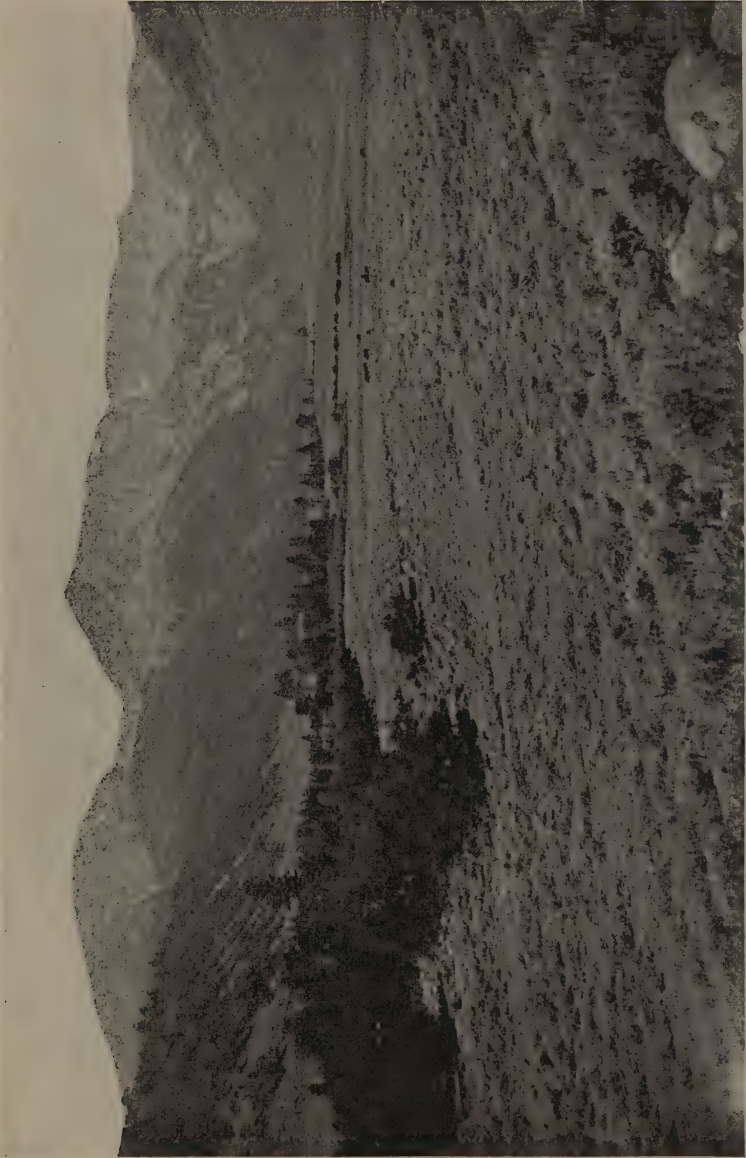
in of the approaches. The bridge will have a 20-foot roadway, with footpath on south side 4 feet wide. The capacity of the bridge will be 1,600 pounds per lineal foot, live load. The earthwork will cost not less than \$600. The abutments are designed to contain 140 cubic yards of concrete. This should cost about \$6 per cubic yard, or \$840. We then have for earthwork and abutments \$1,440, leaving the sum of \$2,357 to pay for the steel, lumber, and labor of putting the bridge in place. Considering that this work is to be done by contract, this is a reasonable figure.

STONE BRIDGES.

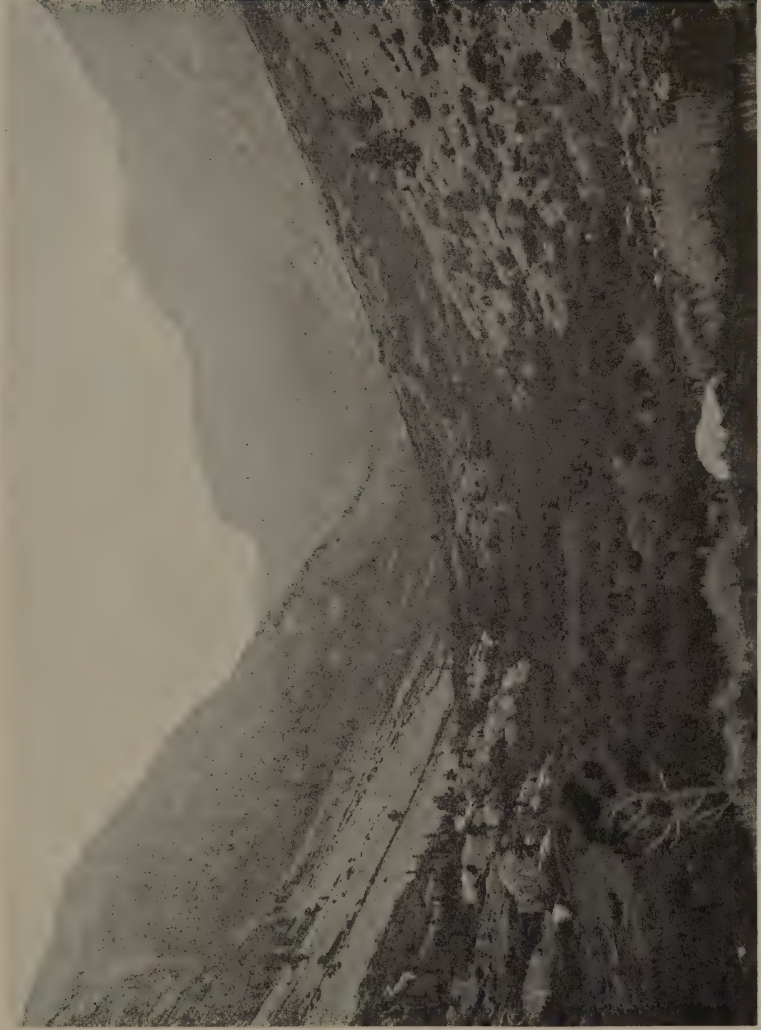
We cannot close this chapter of our report without referring briefly to some stone bridges constructed in Napa County. By reference to the table heretofore given, we see that Napa County has constructed one stone bridge, consisting of three spans, 55 feet in length each, for the sum of \$14,500. Another of three spans, 70 feet each, for the sum of \$19,980, and a third of 30 feet, for the sum of \$3,327 25. Other counties have constructed masonry bridges of smaller dimensions, but we call attention to the above cases in order that some conception may be formed of what a stone bridge will cost. Other counties possess excellent materials for masonry substructures; Nevada County is one of these. Immediately in the vicinity of many of the steel bridges constructed in this county an abundance of stone could be had for the quarrying. The steel bridge that cost \$6,248 could have been constructed of stone at a cost but very little in excess of the cost of the present structure. A stone bridge will last for ages, while the life of a steel bridge is scarcely more than fifty years, and the floor requires constant renewal. The stone bridge in Napa County that cost \$19,980, replaced an old wooden bridge that had cost the county little less than \$50,000. These savings in the cost of structures, and in the selection of the proper materials, have been attained by giving this work into the charge of skilled men of integrity, trained in the use of materials, and with a knowledge of their cost. Reform in road-building will come only when this class of men shall be selected for office, irrespective of their political faith.

IMPORTANT LINKS IN THE SYSTEM OF STATE HIGHWAYS.

There are two important links in the system of State Highways herein set forth, which lie through sections of the Sierras which are so sparsely inhabited that there is little possibility of their being constructed by the counties in which they lie; at the same time, these links are much needed by a large number of citizens of the State at large, and would serve to make the Yosemite Valley, the high Sierras, and Lake Tahoe more attractive and accessible. These links are (1) a road con-



LEAVING CREEK CAÑON, SHOWING BEST ROUTE FROM TIOGA ROAD INTO MONO LAKE BASIN.



HEAD OF MILL CREEK CAÑON. MONO LAKE BASIN.

necting the easterly end of the Tioga road with Mono County roads; and (2) a road around Rubicon Point and the head of Emerald Bay, connecting the roads now reaching the northern and the southern end of Lake Tahoe. The importance of the first mentioned link was recognized by the Bureau in the first Report (pp. 67-68), and by the Legislature of 1897, which body passed a bill providing that this link be built. But the title of this bill was defective, and it failed to become a law. This route is important by reason of its position between Sonora Pass and Walker's Pass, in which distance of over two hundred miles no wagon road crosses the Sierras.

Sonora Pass lies north of the Great Cañon of the Tuolumne, and therefore persons crossing through that pass have to make a great detour to the lower end of that cañon to reach the Yosemite Valley. Walker's Pass is south of the headwaters of Kings and Kern rivers, and is not approachable by road from the Yosemite Valley. The Tioga road leaves the Big Oak Flat road near Crocker's Station, crosses the Sierras at McLane's Pass over well-located lines, along the most feasible route between the passes just mentioned. It reaches a point in the basin of Mono Lake on Levining Creek at an elevation of about 9,800 feet above sea level. From this point three routes are feasible: To the northeast over the divide between Levining Creek and Mill Creek, reaching an elevation of 10,100 feet above sea level, and down the cañon of Mill Creek; to the east down Levining Creek; and to the southeast over Bloody Cañon, reaching an elevation of 10,200 feet and down the same—all reaching Mono County roads.

Realizing the importance of a careful comparison of these routes and the selection of that one which would best serve the interests of the State, Commissioner Manson examined Mill Creek and Bloody Cañon in 1896, and particularly examined the cañon of Levining Creek.

In 1897 Commissioner Price and Commissioner Ashe examined Bloody Cañon and a route via May Lundy mine and a tributary of Mill Creek, and Commissioner Price particularly examined Levining Creek.

In 1898 Commissioners Price and Manson examined the Mill Creek route throughout its entire length, and Commissioner Manson went through the cañon of Levining Creek on foot. The Department is therefore in possession of the facts necessary for a comparison of these routes.

In this comparison the following important features are to be considered:

- (a) Minimum elevation to be overcome.
- (b) Stability of roadbed and freedom from slides.
- (c) Freedom from snow and early opening in the spring.
- (d) Minimum cost of road.
- (e) Service to local interests.

In these, the Levining Creek route stands first in the requirements marked (*a*), (*b*) and (*d*); second in (*c*) and last in (*e*). The Mill Creek route stands first in (*e*), second in (*d*) and last in (*a*), (*b*) and (*c*). The Bloody Cañon route stands first in (*c*), second in (*b*) and (*e*), and last in (*a*) and (*d*).

We therefore recommend that the Levining Creek route be selected, and that an appropriation of \$30,000 be made to construct a roadbed 16 feet wide to connect the Tioga road with Mono County roads, near the mouth of Levining Creek. This road would then constitute the eastern end of Highway No. 16 as herein recommended in the Act to classify the roads in the State of California, and to define each class.

THE LINK AROUND RUBICON POINT AND EMERALD BAY.

The importance of this link lies in the fact that it is a part of State Highway No. 6, in the Act to classify the roads of the State, and that it connects the road now reaching the south end with those reaching the north end of Lake Tahoe. There was a bill introduced in the Legislature of 1897 providing for its construction, but this bill was not passed.

The general route of this road was the subject of study in the Report of this Bureau in 1897. During the current year petitions were forwarded to this Department, asking that more extended examinations be made. In consequence, during October Commissioner Manson made an examination of the route. There are no great difficulties to be overcome, the principal being the objection of owners of summer residences along the shore of the lake, to location of the route, which, in their opinion, would cut their property to disadvantage. The length of connecting road required is about twelve miles. It will be along a highly picturesque portion of the lake shore, and abutting slopes, and will serve the needs of large numbers of visitors to the lake. The estimated cost is \$20,000, which expenditure we believe can advantageously and wisely be made in constructing a roadbed 16 feet wide between existing roads.

In this connection we desire to call attention to the fact that this connecting road will make the Lake Tahoe wagon road, now owned by the State, more serviceable, and greatly enhance the attractiveness of a visit to Lake Tahoe. The two engravings hereto attached show the general character of the route around the head of Emerald Bay and over Rubicon Point.



HEAD OF EMERALD BAY, LAKE TAHOE, SHOWING ROUTE OF LINK OF HIGHWAY NO. 6.



RUBICON POINT, LAKE TAHOE. ROUTE OF CONNECTING LINK, ON HIGHWAY No. 6.



FOREIGN ROADS.

We herewith submit the report of Commissioner Manson on foreign roads, which was made at the request of this Department, provided that no expenses incurred should be chargeable to the State:

To the Honorable the Department of Highways:

GENTLEMEN: On the 2d of July, 1897, I was granted leave of absence to attend the seventh session of the International Geological Congress, held at St. Petersburg, Russia. The extended excursions planned by the officers of the Geological Committee, and the countries traversed, afforded an opportunity to collect data on highway location, construction, and maintenance. This data was collected as opportunity could be had from the following countries: (1) Pennsylvania; (2) from excursions on foot through Normandy, France; (3) Germany; (4) from traveling several hundred miles over the highways of Russia and the extreme western part of Siberia and Asia Minor; (5) from Northern and Central Italy, including ancient and modern roads and streets; (6) from an examination of two of the great trans-Alpine roads of Switzerland, Italy, and France, and (7) of a subsequent trip through England and Wales. Also, from an examination of some of the streets of the following cities: (1) Philadelphia; (2) Chicago; (3) New York; (4) Havre; (5) Rouen; (6) Paris; (7) Cologne; (8) Berlin; (9) Warsaw; (10) Moscow; (11) Samara; (12) Sizran; (13) Katherinebourg; (14) Perm; (15) Nijni Novgorod; (16) St. Petersburg; (17) Tiflis; (18) Odessa; (19) Turin; (20) Rome; (21) Florence; (22) Venice; (23) Basle; (24) London; (25) Liverpool; (26) Swansea; (27) Cardiff; (28) Bristol; (29) Birmingham, and (30) New Castle on Tyne.

The notes and observations will be given in brief, with the hope that, although hastily gathered, they will add something to the general store of facts and serve either as guides toward the good, or warnings as to the bad.

The highways of the State of Pennsylvania were observed from Pittsburgh to Philadelphia; photographs of some of these are herewith submitted. The road from Philadelphia to Chester is a modern toll road constructed on Telford principles. Some of the adjacent roads are yet in their original condition, that is, ungraded, undrained, earth roads, of

the usual country type—costly in the extreme from constant half patching, and nearly impassable from mud in wet weather and for some days after long rains. The suburban feeders are in some instances paved with brick or macadamized. Illustrations of these are appended, and are: (1) The Philadelphia and Chester road; (2) branch road, unimproved; (3) brick paved road; (4) macadamized roads in improved grounds.

Through the limestone districts of Pennsylvania, particularly between Pittsburg and Lancaster, several rock-crushing plants were observed. These were of compact and efficient types, and the country roads were in excellent shape and farming interests evidently prosperous. No rock-crushing plant was observed, either in Pennsylvania or elsewhere, of the size and capacity of the State rock-crusher at Folsom. Road-building in those parts of the State traversed has been greatly advanced in late years.

ROADS IN FRANCE.

The roads examined in France were: First, the roads in and around Havre, Rouen, and Paris; second, the Alpine roads west of the Swiss frontier near Basle and the Italian frontier, approaching and over St. Gothard and Mount Cenis passes.

The roads about Havre are in excellent condition, and have the general features described in texts and treatises on French roads.

The main highway extending eastwardly through Gréville was traversed for some ten miles. A photograph of this road is submitted, which gives the characteristic features. The principles of location, drainage, and surfacing are very correctly carried out; the roadbed is macadamized with the hardest rocks—particularly chert, basalt, or trap, mixed with limestone or chalk. This latter grinds and cements the whole into a hard and impermeable surface. As is the almost universal custom on west European roads, broken rock is piled along the sides of the road for repairs, and as soon as a depression occurs, it is promptly repaired.

Around Rouen, some two hundred miles above Havre, and at the head of deep-water navigation on the Seine, the roads are of the same type. Several photographs and cross-sections of the roads are submitted. These same features are characteristic of the roads of northern France, reaching their greatest perfection around Paris.

The following general observations on the highway system of France are worthy of special note:

1. The location of the road upon easy grades is considered of the highest importance.
2. Thorough drainage is never neglected, and is accomplished (*a*) by

side drains, (b) by sloping the subgrade to the sides and rolling it, (c) by under-drains through the center if necessary.

3. Makeshift methods are never allowed; thus expensive repairs are avoided. Thorough permanent work is found cheapest.

4. The road surface is made of the hardest rocks available, particularly boulders and cobble scattered over fields are broken and mixed with softer rocks to form a binding material.

5. The horse rollers weigh about seven tons, and the steam rollers double this weight. Thorough sprinkling during rolling and the free use of the roller are considered essential.

6. Prompt repairs are never neglected.

7. Engineering supervision and control in location, construction, and maintenance.

As a general thing, the roads of France are of five classes: (1) National highways; (2) Department highways; (3) Important roads; (4) Neighborhood roads; (5) Interfarm roads. Of these, the highways are maintained at national and departmental expense—the roads by the districts in which they lie. Cross-sections, photographs, and slides are presented herewith.

GERMAN ROADS.

The roads observed in Germany were those in the regions around Koln and Berlin and the intervening country. They presented no special feature beyond the thoroughness in location, construction, and maintenance characteristic of German people. The rolling and sandy country permits of good drainage. The excellent plan of restricting the width of paved roadway to the actual needs of the locality is a marked feature of German roads, the usual width being from 14 to 18 feet for main roads, and 8 feet for small district or farm roads. Principal highways were from 18 to 24 feet. Some of these roads were evidently very old; the majority were located and constructed during the last few centuries.

In repairing the roads the usual continental system is observed and the macadam surface is renewed at from twelve to twenty years, dependent upon the amount of traffic and the durability of stone.

Tree-planting is systematically done. Deciduous forest and fruit trees are invariably selected.

ROADS IN RUSSIA.

In the wide expanse of Russia in Europe every variety and type of road exists. The photographs and cross-sections of these roads are numerous and present the general features both of improved and unimproved types. A few special roads will be noted.

In the neighborhood of towns and villages the roads are frequently paved with broken stone or small cobbles. Most of the crossings on railroads are similarly paved; now and then important highways are graded and macadamized. The great roads leading into Siberia traverse such enormous distances that it was possible to travel or cross them only at widely separated intervals. The most important road in Russia, and the one presenting most points of interest to Californians, is the military road traversing Darial Pass in the Caucasus. The features of this road will be specially mentioned later.

In Poland, around Warsaw, the country is flat and badly drained, but well-constructed macadam roads are not uncommon; the section of one is herewith appended. The ditches are of ample section, in order to give good drainage. Piles of rock are distributed along the sides, and the roads frequently bordered with white guard stones standing on either side about fifteen to twenty feet apart and some of them are two feet high. The stones used for macadam are very variable in composition and appearance, being selected from the miscellaneous glacial débris scattered over the country. Much of the road between Moscow and Nijni Novgorod is paved with broken rock well fitted together and laid flat. There is a rough curb of large stone on the side and a broad shoulder of earth between the road and the ditch. The general features and dimensions are given in the section. The rock used is mostly from glacial drift and is, hence, variable in character. One of the trans-Ural roads into Siberia was traversed for some miles near Kychkym. This road is not well located, but is "graded," like many miles of road in California, upon lines parallel with the surface of the ground, that is, it undulates with the country. This road is very wide, being 80 to 85 feet between ditches. Along the sides silver birch grow at irregular distances. Bridges over small streams are of rough dry rubble. Much of the roadbed is decomposed granite and some is macadamized; a general section is given. The climate is dry, judging from the cross-sections of the streams and from the growth. The road has evidently not been closely cared for since the era of railroad construction. The roads through central and northern Russia are much used in the winter when protected by snow; during the spring and early summer they are generally very muddy, and during the late summer and early autumn are dusty.

In the neighborhood of Rostov the following section is used. The section is typical and answers the needs of the locality.

THE MILITARY ROAD OF THE GEORGIAS.

Of modern Russian roads the great highway over the Caucasus is an enduring example of energy and power. This road occupies the historic pass known as Darial Pass, which for time immemorial has been

an important line of travel between Asia Minor and southeastern Europe. The Caucasus Mountains skirt the northeastern shore of the Black Sea, and from thence run southeasterly the Caspian. They are, in many respects, analogous to the Sierras, but are larger, broader, and longer. Mount Elbruz, reaching an altitude of some 18,000 feet, is over 3,000 feet higher than the highest peaks of the Sierras. Up to the conquest of the Caucasian regions by Russia, only a narrow, badly graded, and rough road existed. Portions of it can be seen on the northern approach in the cañon of the Tirek River, and some fifteen to twenty miles south of the Vladikavkaz, the northerly terminus of the road. Recent deposits of débris in the bed of the river have brought the flood plane above the ancient roadbed. An interesting section of this road is given as it skirts beneath a rocky bluff on the right bank of the Tirek. The road lies in a shelf hewn into the solid rock; at the point at which the section was taken columns of rock were left to support the overhanging bluff. An attempt to photograph this bluff failed by reason of the deepening shadows of twilight. A large slide from the glacial slopes of Kasbek covered this road for some miles in 1890. A temporary road was built around the slide, and so well was it fitted against the precipitous bluff that the Russian engineers have marked it by painting the adjacent rocks white, so that the traveler may note the skill and care given to road work. The substructures of this great road are principally stone; one or two bridges are of steel. Types of both are given in the accompanying photographs and slides.

In a few instances snowsheds have been built. These structures rest upon massive stone walls with well-braced wooden roofs sheathed with iron. On the outside a summer road is constructed, each road being about 22 feet wide.

The grades of the road are light and have been accurately fitted to the topography; the maximum grades rarely exceed eight or nine per cent. The roadbed is thoroughly drained and well macadamized, and piles of broken rock are abundant for prompt repairs. The rock used varies with the formation—limestone, trap, and the harder volcanic and metamorphic rocks being preferred. The only machinery observed on the entire road was a heavy and clumsy road-roller. The photograph submitted gives its general appearance. The following data and measurements were taken: Length of frame over all, 18 feet; width, 7½ feet; tongue interchangeable; small rollers on each end; brakes operated by screws check the roller on heavy grades; boxes for wet sand ballast on each end, 6'6" by 2'8" by 1'10", lined with No. 18 galvanized iron; estimated gross weight, 11 tons. In road repairs the traffic is depended upon to pack the rock. Laborers are distributed along the road, but the variations in travel, climate, rainfall, etc., are so great that the force is very variable. On the southern end the road has

been blocked at many places by immense quantities of *débris* brought down from the tributaries of the Arangua; and at several places large forces of laborers were engaged in rebuilding the road, and in constructing *débris* diverting and retaining works. It was a readily noted fact that the greatest damage was done by those tributaries from the watersheds of which the timber had been cut away, and a close observer could readily determine whether a tributary watershed was timbered or not by the amount of damage done by the summer rains.

The Russian engineers deserve great credit for the skill with which they have constructed and are maintaining this road. Its northern end is in the cold temperate regions around Vladikavkaz; its summit reaches 8,000 feet, and is subject in winter to Arctic conditions. The southern end is in the sub-tropical climate of Tiflis. The northern slope of the Caucasus is dry, rugged, and precipitous; the growth is coniferous. The southern slope is more gentle and characterized by rounder mountain forms, with broader and more extensive deposits at the base. Summer rains give deciduous trees on the south slope, and if conifers ever existed there they have long since disappeared. Thus, the physical features and conditions are of great range and tax the engineer to meet them in their varying phases.

CRIMEAN ROADS.

The principal Crimean roads are well located, drained, and macadamized; the section given presents their general type. The principal stone used in macadamizing is limestone, which in the dry climate of Crimea pulverizes into a fine whitish dust.

SWISS ROADS.

Since the Roman engineers, over two thousand years since, demonstrated the principles of road-building, Switzerland has been the field for modern roads. Prior to the era of railroad-building, the great lines of travel and trade between portions of Germany, France, and Italy passed through the Swiss Alps, and even to-day, with double tracks of railroads traversing the valleys and piercing the divides in every direction, more than 8,400 miles of magnificent roads are maintained, or one half mile to each square mile of territory—the area of Switzerland being 16,000 square miles, or 4,000 square miles less than that of San Bernardino County. Considering the mountainous character of the country, this mileage is very large. The earlier Roman roads were parts of a transcontinental system, and even until the middle of the present century the roads of Switzerland served the same purpose. The Roman roads fell into poor repair during the Middle Ages and were neglected

until about the first part of the present century, when an era of rebuilding dawned with the reconstruction of the great Simplon road, by Napoleon, in 1800. In the next three quarters of a century the greater portion of the Swiss roads were built or rebuilt. All parts of Switzerland are thus reached by magnificent roads, which permit its grandeurs of scenery and climate to be the annual Mecca of many thousands of the 100,000,000 people living within a radius of 800 miles of Mount Blanc. In locating these roads true-grade lines were fitted to the ground, and, as far as possible, on the sunny side of the valleys; the roadbeds are well graded and solidly built, generally on a system resembling the more modern Telford system. The older roads were 8 to 12 feet wide, and the modern roads from 12 to 24 feet, according to the class.

The reason of the durability of both the Roman and the modern Swiss roads is the solidity of the former and the thorough drainage of the latter. The surface of the roadbed is made of the most durable rock—the main principles being to construct a well-drained foundation and substructures; and, second, to utilize the best and most available material for road surfacing. Types of roads and structures are illustrated in the accompanying photographs and slides.

ITALIAN ROADS.

So much has been written and is available about the ancient and modern roads of Italy, that it is not necessary to more than outline the results of the short examination which the writer was able to make.

The old Roman roads served the place of the railroads of to-day, and extended from Jerusalem, in Asia Minor, through all the countries of southern Europe into Germany and Scotland. Hence, the main lines of travel in these countries show the results of Roman engineering work. The one most particularly referred to is the Via Apia, extending from Rome to Brindisi, in the southeast end of Italy. Several photographs of this road are submitted herewith, which give the general appearance of the northern fifteen miles. It is probable that this road was not used by the Romans in the condition we now find it—paved with rough stones and too irregular and hard to have been used by unshod horses. Modern Roman engineers are of the opinion that the ancient roads were covered with fine-broken rock, and what we see is the massive foundation of this road surface. There are many facts substantiating this opinion.

The Via Latina is another example of the massiveness of early Roman construction, a cross-section of which is given; in addition, there are nine cross-sections of typical roads and streets of Italian cities; of these, it may be said that the perfection of basalt block pave-

ment is found in modern Rome. The blocks are about four inches square on the face and six inches deep, pyramidal in form, and very regular in shape. These are closely laid on packed sand and rammed until in perfect shape. They afford a pavement of unexcelled durability, thoroughly smooth and clean, but noisy under traffic.

Macadam is largely used in streets; where cobblestones are used, broad, flat stones are laid for the wheels of vehicles, as in Ferrara. The most instructive example of road-building in northern and central Italy is the Via Apia Nuevo, which has replaced the old Via Apia. This new road is better located, and is a modern macadamized road, in which good drainage and surfacing replace the massive and expensive foundation of the old Roman roads.

Cross-sections, photographs, and slides of this road accompany this report. The following drawings, photographs and slides of Italian roads are also submitted: Nine sections of roads and streets; eight photographic slides, illustrating principal roads and durability of materials, etc.

The roads of Italy are divided into four classes, but the divisions between the two lower classes are so slight as to really leave only three—National, Provincial, and Neighborhood, or District. Each class is cared for, as the nomenclature indicates, by national, provincial, or district authorities, and in some of the poorer provinces the roads are in bad condition. Whenever a railroad parallels a national highway, this latter is classified as a provincial highway, and is turned over to the authorities caring for such class.

ENGLISH ROADS.

The subject of road-building revived in England during the days of Macadam and Telford. The road literature of that and subsequent periods is abundant and accessible; but it may be well to call attention to the few isolated features which catch the engineer's eye, and which are not generally cited in texts and treatises on roads. Around Bristol, many examples of Roman road construction exist which present features somewhat different from Roman roads elsewhere observed. First, the skillful fitting of the road to the ground is lacking in many instances. This indicates that either unskillful engineers were sent to that remote province, or that the early students of Roman methods were not accurate in their application of first principles. This error once started was followed for centuries, and not entirely corrected since the days of Macadam.

Throughout Wales and southwestern England, excellent macadam roads are maintained. The materials selected are basalt, trap, and the silicious rocks. Around Yorkshire, the excellence of the roads is due in

a large part to the thoroughness of drainage, which in the moist climate of England is as essential as it is in the wet season of California. An important lesson for our home road-builders to learn, and one which cannot too often be brought to their attention, is that thorough drainage is of the most vital importance. In northeastern England, around New Castle on Tyne, old Roman roads exist, but have been so thoroughly replaced by railroads and modern highways that they are more objects of antiquity than serviceable highways. Important lessons in street construction and maintenance are learned in the great cities of England, and it would well repay our young and growing cities of California to select a thoroughly trained engineer and send him to study these lessons for six months or a year, and then keep him applying them at home. Asphaltum and bitumen, for instance, are never "stewed" or "steamed" to soften them, but are slowly heated and all matter volatile below 275° or 300° Fahr. is driven off. The thoroughly refined material is well mixed with dried and heated sand and limestone, and laid not more than one and a quarter inches thick. Such a pavement was intact after five years of the heaviest traffic in London; whilst in San Francisco, a better native material laid three inches thick was entirely gone under the lightest traffic in a short time. This difference in durability is mainly due to the fact that the principle known to the old Greeks, that all matter volatile below 300° Fahr. must be driven off, was thoroughly applied in the one instance and as thoroughly ignored in the other. Again, the London asphalt was laid on a hard, well-floated concrete surface. In the San Francisco instance, the concrete was hardly worthy of the name, and the ignorant city authorities were persuaded into the idea that the concrete surface should be "rough" in order that the asphaltum could "take hold." This permits of poor workmanship and a deficiency of mortar in the concrete. A sample of the London asphalt is herewith presented for comparison with home work. In some of the English roads, a stiff ferruginous clay is used in very small proportions as a binder to very hard, broken rock. The road system is in general well kept up, and it is a rare pleasure to drive; so much so that a larger proportion of expensive teams and vehicles are kept up for this purpose than in any other country.

The foregoing notes were hurriedly gathered, with some forty cross-sections and over two hundred photographs and slides; they are submitted with the hope that they may serve to revive and extend our knowledge of road-building.

Very respectfully,

(Signed:)

MARSDEN MANSON.

APPENDIX A

Showing Expenditures for Roads from 1886 to 1897.

County.	Expended for Roads Fiscal Years 1886-1895.	Expended for Roads Fiscal Year 1895-1896.	Expended for Roads Fiscal Year 1896-1897.	Total.
Alameda	\$813,851 78	\$149,877 50	\$110,042 30	\$1,073,771 58
Alpine	6,590 86	1,057 18	760 39	8,408 43
Amador	160,826 53	10,042 53	16,977 18	187,846 24
Butte	581,235 18	48,897 39	45,568 53	675,701 10
Calaveras	108,943 24	15,154 93	7,744 03	131,842 20
Colusa	565,313 97	31,585 01	29,723 88	626,622 86
Contra Costa	480,615 17	61,266 59	44,215 06	586,096 82
Del Norte	91,183 53	6,040 54	5,861 02	103,085 09
El Dorado	163,408 29	11,086 32	14,979 63	189,474 24
Fresno	603,514 26	51,049 85	65,062 53	719 626 64
Glenn	114,933 19	28,001 07	20,350 37	163,284 33
Humboldt	706,063 93	55,475 90	55,783 66	817,323 53
Inyo	38,977 63	4,342 03	2,944 58	46,264 24
Kern	495,031 78	54,856 80	35,267 66	585,156 24
Kings	20,923 45	11,509 47	15,972 42	48,405 34
Lake	137,655 76	14,718 66	13,015 40	165,389 82
Lassen	77,621 53	11,049 83	9,479 05	98,150 41
Los Angeles	884,745 82	77,207 16	101,530 52	1,063,483 50
Madera	46,094 36	15,464 49	17,289 51	78,848 36
Marin	211,846 93	24,860 22	22,447 44	259,154 59
Mariposa	66,275 29	6,317 48	7,415 38	80,008 15
Mendocino	508,518 55	40,851 75	39,528 78	588,899 08
Merced	516,524 95	49,491 97	41,071 57	607,088 49
Modoc	83,821 42			83,821 92
Mono	13,966 36	2,417 54	5,189 69	21,573 59
Monterey	462,903 55	48,972 92	55,163 64	567,040 11
Napa	316,640 81	26,138 55	23,208 02	365,987 38
Nevada	193,863 37	41,182 49	25,912 61	260,958 47
Orange	139,447 07	20,363 14	23,789 54	183,599 75
Placer	333,719 78	40,072 30	30,650 22	404,442 30
Plumas	149,497 23	15,759 36	12,533 98	177,790 57
Riverside	90,316 49	19,098 26	17,279 27	126,694 02
Sacramento	424,296 95	59,123 69	55,694 32	539,114 96
San Benito	131,831 36	11,807 62	11,888 34	155,527 32
San Bernardino	281,411 94	24,103 03	37,126 91	342,641 88
San Diego	393,851 69	38,409 70	43,968 93	447,230 32
San Francisco				
San Joaquin	448,003 08	43,668 49	39,726 90	531,389 47
San Luis Obispo	436,630 11	26,772 44	29,819 96	493,222 51
San Mateo	496,439 07	60,450 40	58,832 54	615,732 01
Santa Barbara	376,619 81	39,872 00	45,301 70	461,793 51
Santa Clara	960,376 62	143,668 05	138,131 75	1,242,176 42
Santa Cruz	277,783 53	36,485 82	26,637 72	340,907 07
Shasta	165,383 42	19,042 52	17,690 65	202,116 59
Sierra	82,109 73	15,312 51	8,148 83	105,571 07
Siskiyou	221,632 82	18,915 91	18,078 11	258,626 84
Solano	414,879 03	47,850 18	53,830 12	516,659 33
Sonoma	489,665 56	62,064 16	61,872 31	613,602 03
Stanislaus	248,134 35	48,022 87	43,831 53	339,988 75
Sutter	54,567 44	7,459 82	9,226 98	71,254 24
Tehama	238,770 13	23,707 50	23,474 80	285,952 43
Trinity	57,440 47	4,395 72	4,218 17	66,054 36
Tulare	490,601 89	41,433 68	40,846 01	572,881 58
Tuolumne	75,881 73	9,613 26	13,966 99	99,461 98
Ventura	270,796 77	32,669 40	33,109 57	336,575 74
Yolo	431,988 48	52,544 69	42,854 73	527,387 90
Yuba	165,857 27	15,518 66	14,087 18	195,463 11
Totals	\$16,829,915 35	\$1,877,121 35	\$1,789,122 91	\$20,467,269 31

APPENDIX B.

Expenditures of Department up to and including November 1, 1898.

Commissioners' salaries from May 25, 1897—three Commissioners at \$250 per month each	\$12,900 00
Secretary's salary from June 1, 1897, at \$125 per month	2,125 00
Stenographer's salary from June 1, 1897, at \$100 per month	1,700 00
Janitor's salary from June 1, 1897	680 00
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	\$27,405 00

TRAVELING EXPENSES.

MARSDEN MANSON—

1897—June 30	\$57 35
1898—Jan. 31	41 40
April 2	98 85
April 31	62 70
May 31	40 15
July 6	72 80
July 30	19 05
Sept. 1	121 30
Oct. 31	38 90
	<hr/>
	\$552 50

J. R. PRICE—

1897—June 30	\$23 30
Aug. 31	28 05
Oct. 1	61 80
Oct. 30	67 70
Dec. 3	38 60
1898—Jan. 8	81 35
Jan. 31	45 05
Mar. 4	38 90
April 2	16 80
April 30	51 95
May 31	45 60
July 6	38 70
July 30	40 75
Sept. 1	64 75
Oct. 5	79 70
Oct. 31	78 90
	<hr/>
	\$801 90

W. L. ASHE—

1897—June 30	\$50 30
July 8	34 75
Aug. 31	28 60
Sept. 1	10 05
Oct. 1	88 08
Oct. 30	98 85
Dec. 3	31 55
1898—Jan. 8	47 10
Jan. 31	20 10
Mar. 4	58 55
April 2	75 80
April 31	153 57
May 31	134 90
July 6	132 50
July 30	83 75

W. L. ASHE—Continued.

1898—Sept. 1.....	\$13 25
Oct. 5.....	106 20
Oct. 5.....	11 50
Oct. 31.....	6 00
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	\$1,186 00

A. L. HENRY—

1898—April 29.....	\$75 25
May 31.....	60 20
July 30.....	6 35
Sept. 1.....	40 65
Oct. 5.....	80 50
Oct. 31.....	20 20
	<hr/>
	\$283 15

D. C. McCALLUM—

1898—May 31.....	\$3 40
July 6.....	37 45
Oct. 31.....	7 65
	<hr/>
	\$48 50

MISCELLANEOUS.

1897—June 30—Sunset Telephone Company.....	\$12 70
June 30—Wells, Fargo & Co.	46
June 30—John T. Stoll	2 50
June 30—H. S. Crocker Company	3 25
June 30—L. H. Morse	5 00
June 30—F. H. Wing.....	13 00
June 30—D. McKay	5 00
June 30—John Breuner	175 75
June 30—Western Union Telegraph Company.....	4 32
June 30—Sayre & Son	1 00
June 30—Sunset Telephone Company.....	3 50
June 30—Schad Bros.	27 95
June 30—H. S. Crocker Company	10 15
June 30—Mrs. H. C. Chipman	9 50
June 30—F. H. Wing.....	1 00
June 30—T. P. Andrews.....	3 07
June 30—Henry Klehn.....	50 00
June 30—A. Lietz Company	53 00
June 30—Daniel Flint.....	12 00
June 30—T. P. Andrews.....	149 30
June 30—T. P. Andrews.....	24 75
June 30—T. P. Andrews.....	24 00
June 30—Postage stamps.....	100 00
June 30—W. K. Cothrin.....	2 20
June 30—C. W. Goddard	12 00
June 30—S. P. Tressler	6 00
June 30—Alex Holmes	19 75
June 30—Wells, Fargo & Co.	2 00
June 30—Press Clipping Bureau	9 00
Aug. 31—Schad Bros.	34 75
Aug. 31—Alex Holmes.....	49 00
Aug. 31—Weinstock, Lubin & Co.	18 50
Aug. 31—C. W. Goddard	4 00
Aug. 31—Sunset Telephone Company.....	10 10
Aug. 31—Wells, Fargo & Co.	70
Aug. 31—Freeport Telephone Company	1 00
Aug. 31—H. S. Crocker Company.....	3 50

1897—Sept.	1—Hall, Luhrs & Co.	\$38 09
Sept.	1—J. E. D. Baldwin	3 28
Sept.	1—Wells, Fargo & Co.	50
Sept.	1—Bailey & Neave	6 00
Sept.	1—G. W. Rogers	1 50
Sept.	1—T. P. Andrews	6 10
Sept.	1—Schad Bros.	38 65
Sept.	1—Charles E. Phipps	4 25
Oct.	1—Sunset Telephone Company	7 00
Oct.	1—D. McKay	2 00
Oct.	1—Neostyle Manufacturing Company	2 36
Oct.	1—Wawona Hotel Company	17 00
Oct.	1—Coffman & Kenny	158 00
Oct.	1—Schad Bros.	10 85
Oct.	1—J. W. Bird	1 10
Oct.	1—Hall, Luhrs & Co.	1 05
Oct.	1—Sunset Telephone Company	9 05
Oct.	30—Bailey & Neave	5 00
Oct.	30—Frank H. Wing	1 50
Oct.	30—Press Clipping Bureau	9 00
Oct.	30—Schad Bros.	39 00
Oct.	30—Charles E. Phipps	3 90
Oct.	30—Sunset Telephone Company	10 25
Oct.	30—H. S. Crocker Company	1 00
Dec.	3—Richardson & Sanborn	4 00
Dec.	3—Moses Rogers	19 00
Dec.	3—Western Union Telegraph Company	71
Dec.	3—Wells, Fargo & Co.	30
Dec.	3—Schad Bros.	36 00
Dec.	3—A. L. Henry	97 00
Dec.	3—Sunset Telephone Company	12 30
Dec.	3—Alex Holmes	14 55
Dec.	3—Postage stamps	35 00
Dec.	3—Wells, Fargo & Co.	1 95
1898—Jan.	8—H. S. Crocker Company	3 15
Jan.	8—Press Clipping Bureau	6 00
Jan.	8—T. P. Andrews	55 10
Jan.	8—Wells, Fargo & Co.	1 10
Jan.	8—Geo. Kanzee	8 80
Jan.	8—Riverside Telephone Company	45
Jan.	8—C. A. Garthorne	47 00
Jan.	8—T. P. Andrews	12 00
Jan.	8—Schad Bros.	32 95
Jan.	8—Sunset Telephone Company	15 60
Jan.	8—Western Union Telegraph Company	2 13
Jan.	8—Mason Towel Supply Company	9 00
Jan.	8—W. K. Cothrin	17 60
Jan.	8—T. P. Andrews	133 00
Jan.	8—Bailey & Neave	2 00
Jan.	31—Sunset Telephone Company	7 55
Jan.	31—Freeport Telephone Company	2 25
Jan.	31—Bassett & Minford	21 00
Jan.	31—H. S. Crocker Company	23 82
Jan.	31—W. A. Seaman	20 75
Mar.	4—Wells, Fargo & Co.	25
Mar.	4—Press Clipping Bureau	9 00
Mar.	4—T. P. Andrews	3 40
Mar.	4—Schad Bros.	39 00
Mar.	4—H. S. Crocker Company	2 75

1898—Mar. 4—H. P. Martin.....	\$5 25
Mar. 4—Freeport Telephone Company.....	50
Mar. 4—Bailey & Neave.....	17 00
Mar. 4—Schad Bros.....	31 55
Mar. 4—Wells, Fargo & Co.	70
Mar. 4—D. McKay.....	9 00
Mar. 4—Kirk, Geary & Co.....	40
Mar. 4—Sunset Telephone Company.....	11 30
Mar. 4—A. L. Henry.....	1 85
April 2—Wells, Fargo & Co.....	2 90
April 2—T. P. Andrews.....	25 00
April 2—Kirk, Geary & Co.....	1 76
April 2—Sacramento Glass and Crockery Company.....	6 75
April 2—Mason Towel Supply Company.....	3 00
April 2—H. S. Crocker Company.....	14 75
April 2—W. K. Cothrin.....	8 85
April 2—F. Lohmeyer.....	10 00
April 2—Schad Bros.....	65 75
April 2—Postage stamps.....	60 00
April 29—Holbrook, Merrill & Stetson.....	6 00
April 29—T. P. Andrews.....	12 05
April 29—W. H. Willis.....	1 50
April 29—D. McKay.....	5 00
April 29—Sunset Telephone Company.....	17 70
May 31—Neville & Co.....	39 25
May 31—T. P. Andrews.....	7 65
May 31—Wells, Fargo & Co.....	4 95
May 31—Bancroft-Whitney Company.....	3 00
May 31—J. C. Henkenius.....	15 00
May 31—D. McKay.....	6 00
May 31—Schad Bros.....	14 55
May 31—H. S. Crocker Company.....	7 80
May 31—Wyckoff, Seamans & Benedict.....	8 55
May 31—Wallace Kay.....	3 00
May 31—F. H. Wing.....	4 25
May 31—Wells, Fargo & Co.....	6 40
May 31—Sunset Telephone Company.....	10 00
May 31—Newman & Scully.....	32 75
July 2—J. O'Leary.....	13 50
July 2—Postage stamps.....	5 00
July 2—Kirk, Geary & Co.....	85
July 2—Press Clipping Bureau.....	9 00
July 2—Mason Towel Supply Company.....	3 00
July 2—Sacramento Glass and Crockery Company.....	4 00
July 2—W. K. Cothrin.....	9 10
July 2—Sacramento Pure Water Company.....	1 50
July 2—Sunset Telephone Company.....	6 45
July 2—Coffman & Kenny.....	34 75
July 2—J. K. Doak.....	16 65
July 2—M. Brum.....	51 13
July 2—Schad Bros.....	9 75
July 2—Sacramento Publishing Company.....	10 00
July 2—D. McKay.....	1 00
July 2—Wells, Fargo & Co.....	1 45
July 2—T. P. Andrews.....	6 65
July 30—T. P. Andrews.....	9 00
July 30—P. A. Byrne.....	16 20
July 30—H. S. Crocker Company.....	11 25
July 30—D. McKay.....	2 75

1898—July 30—Alex Holmes.....	\$6 15
July 30—J. O'Leary.....	33 30
Sept. 1—Sunset Telephone Company.....	22 30
Sept. 1—Schad Bros.	12 20
Sept. 1—F. H. Wing.....	1 50
Sept. 1—Western Union Telegraph Company.....	1 75
Sept. 1—A. Lietz Company.....	5 00
Sept. 1—T. P. Andrews.....	4 15
Sept. 1—Wells, Fargo & Co.	1 10
Sept. 1—Postage stamps.....	25 00
Oct. 5—Schad Bros.	17 00
Oct. 5—Sacramento Pure Water Company.....	4 50
Oct. 5—Wells, Fargo & Co.	45
Oct. 5—Ende & Marre.....	13 25
Oct. 5—Wells, Fargo & Co.	6 30
Oct. 5—T. P. Andrews.....	1 80
Oct. 5—W. K. Cothrin.....	9 20
Oct. 5—Mason Towel Supply Company.....	3 00
Oct. 5—Sunset Telephone Company.....	8 55
Oct. 5—J. W. Bird.....	24 30
Oct. 31—Bancroft-Whitney Company.....	3 00
Oct. 31—Press Clipping Bureau.....	12 00
Oct. 31—Sunset Telephone Company.....	11 00
Oct. 31—Wells, Fargo & Co.	3 35
Oct. 31—Western Union Telegraph Company.....	1 50
Oct. 31—H. H. McPike.....	33 00

